T.O. No. 1F-51H-1
(Formerly AN 01-60JF-1)

FLIGHT HANDBOOK

USAF SERIES
F-51H
AIRCRAFT

Commanders are responsible for bringing this handbook to the attention of all personnel cleared for operation of affected aircraft.

Published under authority of the Secretary of the Air Force and the Chief of the Bureau of Aeronautics.

This publication replaces T.O. No. 1F-51H-1 (formerly AN 01-60JF-1), dated 29 July 1949 and Safety of Flight Supplement AN 01-60JF-1C. This book was complete at time of issue, since there were no outstanding Safety of Flight Supplements.

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LIST OF REVISED PAGES ISSUED

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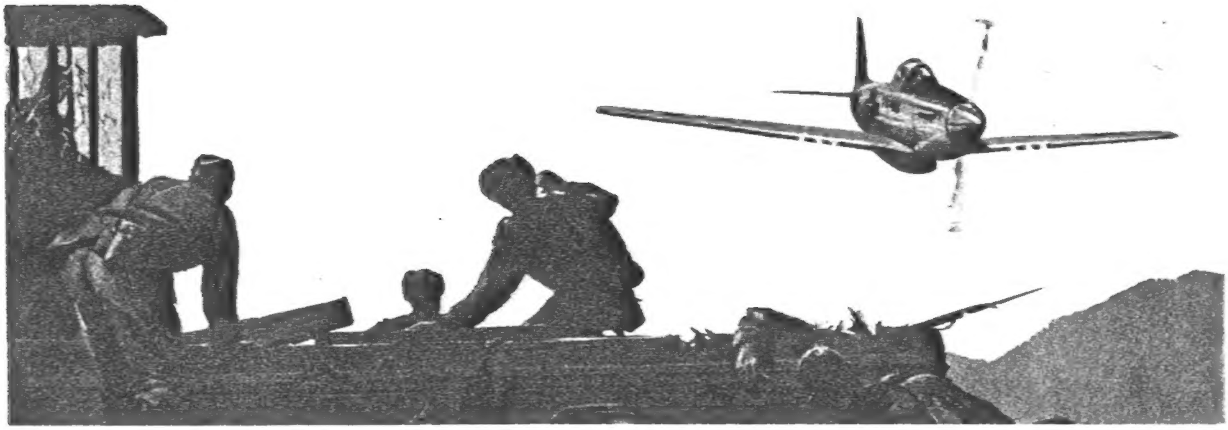

To surprise the enemy when he is unprepared is the ultimate aim of an attack, whether on land, at sea, or from the air. The *only* way of doing this is to arrive at the *target* at a specified time. Only trouble-free operation of your airplane will put you at the right spot at the right time. These first pages will tell you where you can find the information in your Flight Handbook to enable you safely and efficiently to perform your mission. Learn to know your airplane by starting right here, for this handbook is the only technically accurate and constantly current source of F-51H operating data. The information in this handbook is based on engineering and flight test experience of the Air Force and the manufacturer, as well as the service experience of the using commands. North American Aviation and the Air Force have carefully considered your handbook requirements and have cooperated to prepare this handbook in a completely new style that definitely makes the old -1 T.O. obsolete. These new-type handbooks not only are more attractive, but are easier to read and easier to use. You'll note that full use is made of illustrations to highlight descriptions and specific procedures. The Flight Handbooks for all airplanes have not been prepared to the new specification, but the new books can be readily identified by the cover. The old-style book has a small, rectangular photo of the airplane centered on the cover; the new handbook has a full-page cover illustration.

This handbook was prepared solely for your benefit, and you as the pilot of an F-51H should make sure you have a copy for your own personal use. *Air Force Regulation 5-13* specifically provides that each pilot *(except those attached to an administrative base)* is entitled to his own copy of the Flight Handbook for his airplane. Don't let anyone tell you otherwise.

Once you have your handbook, take time to read and study it completely to gain an over-all knowledge of the airplane, and keep it handy for a reference guide.

The Technical Order distribution system works surprisingly well if you do your part. In this respect, it's important that you order your required quantity of handbooks as soon as possible instead of waiting until the need arises. An early order permits the Air Force to print enough books to cover your requirements. If you delay your order, sufficient copies may not have been originally printed, so it may take a long time to fulfill your request.

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The Air Force now issues Safety of Flight Supplements to make sure you get the latest information on critical operational changes in a hurry. These supplements use the same basic T.O. number as your Flight Handbook, except for the addition of a suffix letter. Supplements covering loss of life will get to you within 48 hours after being issued; those dealing with serious damage to equipment will reach you in 6 days. If you have ordered your Flight Handbook on the Publications Requirements Table, you need do absolutely nothing to get these supplements—they'll come to you automatically.

Any comments you have regarding this handbook, suggestions for future books, or questions on any phase of the Flight Handbook program are invited and should be addressed to the Wright Air Development Center, Wright-Patterson Air Force Base, Dayton, Ohio, Attn: WCSOF.

This handbook is divided into nine sections, an appendix, and an index as follows:

Section I, DESCRIPTION—a detailed description of the airplane and the equipment and systems (including all emergency equipment not part of the auxiliary equipment) which are essential for flight.

Section II, NORMAL PROCEDURES—operating instructions arranged in proper sequence from the time you approach the airplane until it is parked after the flight.

Section III, EMERGENCY PROCEDURES—concise procedures to be followed in meeting any emergency (except those of auxiliary equipment) that could reasonably be expected.

Section IV, DESCRIPTION AND OPERATION OF AUXILIARY EQUIPMENT—descriptions and normal and emergency operating instructions for all equipment not essential for flying the airplane, such as cockpit heating and ventilating, oxygen, lighting, armament, and miscellaneous equipment.

Section V, OPERATING LIMITATIONS—all airplane and engine operating limitations that must be observed during operation.

Section VI, FLIGHT CHARACTERISTICS—a discussion of flight characteristics, the advantageous as well as the dangerous, that are peculiar to the airplane as based on extensive flight tests.

Section VII, SYSTEMS OPERATION—a supplementary discussion of special characteristics and factors involved in operating some of the airplane systems under various conditions.

Section VIII, CREW DUTIES—omitted as not applicable for a single-place airplane.

Section IX, ALL-WEATHER OPERATION—supplementary procedures and operating instructions for safe and efficient operation under instrument flight and extreme weather conditions.

Appendix, OPERATING DATA—all operating data charts for efficient preflight and in-flight mission planning. Take-off and landing charts for various gross weights are also included.

Alphabetical Index—a complete listing of material in this handbook, including illustrations, arranged for ease in reference.

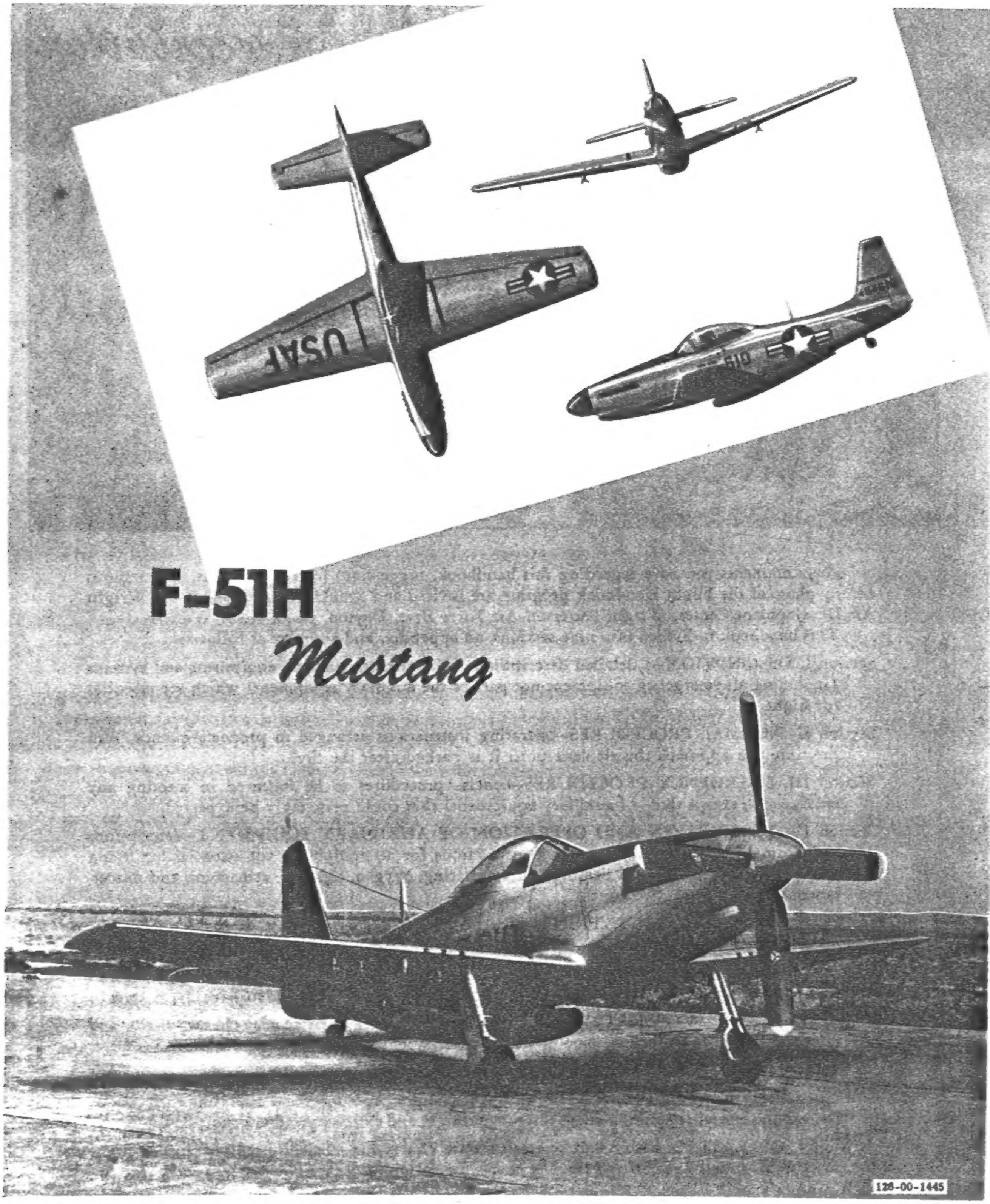
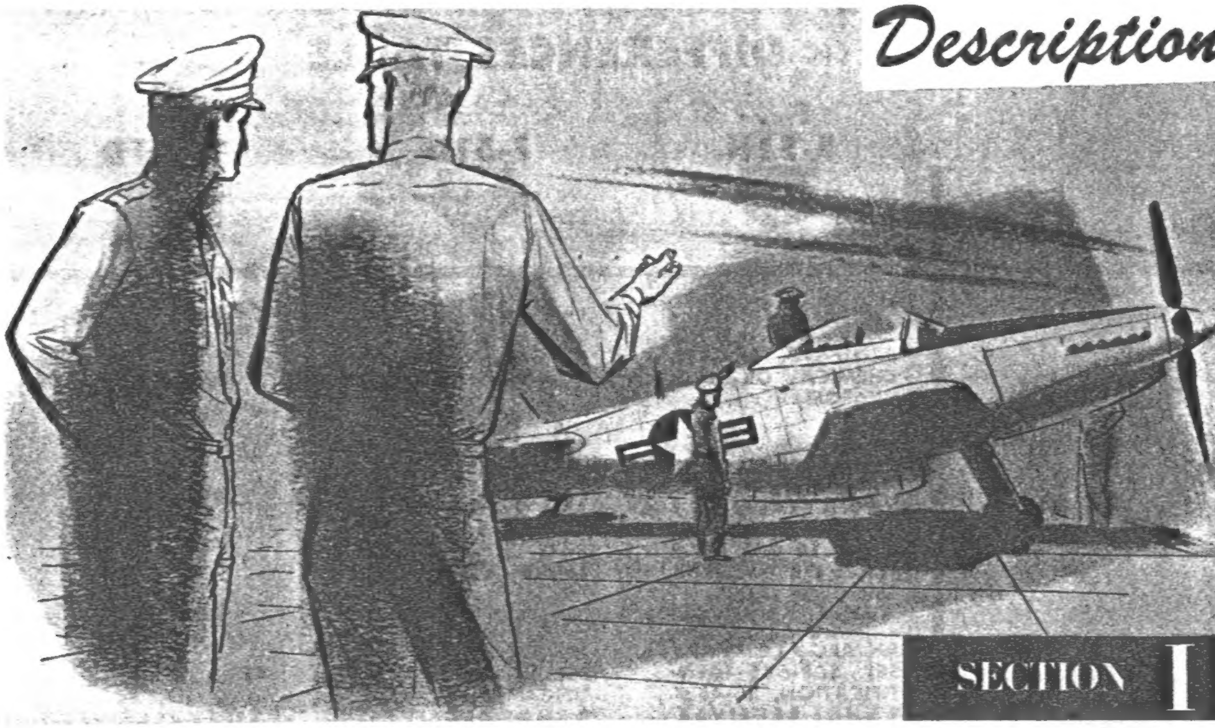


Figure 1-1

SECTION I

Description



AIRPLANE.

The F-51H is a single-place, low-wing fighter monoplane powered by a Rolls Royce liquid-cooled engine. Although similar to other F-51 Model Airplanes in outward appearance, this airplane is of an entirely new design. The airplane is armed with six .50-caliber machine guns and has wing racks to carry bombs, depth charges, chemical tanks, or combat fuel tanks. Provision is also made to mount rockets beneath the wings of the airplane. Armor plate is installed around the cockpit area for protection of the pilot.

AIRPLANE DIMENSIONS.

The dimensions of the airplane are as follows:

Wing span	37 feet
Length over-all	33 feet 4 inches
Height (three-point attitude)	13 feet 8 inches

AIRPLANE GROSS WEIGHT.

The normal gross weight of the airplane with no external load is approximately 8810 pounds and can be as high as 12,600 pounds when external armament and fuel are carried.

ENGINE.

The airplane is powered by a Packard-built Rolls Royce V-1650-9 engine, which incorporates a two-stage, two-speed supercharger and develops 1430 horsepower at sea level at Military Power. The 12-cylinder, liquid-cooled engine drives a four-bladed, constant-speed propeller and is equipped with an injection carburetor and an automatic manifold pressure regulator. An aneroid-actuated switch automatically controls the supercharger blower shift.

ENGINE CONTROLS.

THROTTLE.

The throttle (8, figure 1-5), located on the left longeron, incorporates a gate that allows a maximum of 61 in. Hg manifold pressure up to critical altitude of the engine. When the throttle is moved past the gate, breaking the light safety wire, a manifold pressure of as much as 67 in. Hg dry and 80 in. Hg with water injection is possible for War Emergency Power. The throttle is mechanically linked to the Simmonds automatic manifold pressure regulator used on the engine. A manual override linkage is added to the throttle linkage which will permit manual closing of the butterfly valve in

Main DIFFERENCES TABLE

	F-51H	F-51D	TF-51D
ARMAMENT	THREE .50-CALIBER GUNS IN EACH WING, BOMBING, ROCKET, CHEMICAL, OR DEPTH CHARGES	THREE .50-CALIBER GUNS IN EACH WING, BOMBING AND ROCKET EQUIPMENT	NO ARMAMENT
FUEL CAPACITY US. GALLONS	INTERNAL CAPACITY 260 GAL. TWO 75 GAL DROP TANKS OR TWO 110 GAL DROP TANKS OR TWO 165 GAL DROP TANKS	INTERNAL CAPACITY 245 GAL. TWO 75 GAL DROP TANKS OR TWO 110 GAL DROP TANKS	180 GAL — RIGHT AND LEFT WING TANKS ONLY
RADIO AND ELECTRONICS	AN/ARC-3 COMMAND SET, SCR-695 IDENTIFICATION, BC-453B RANGE RECEIVER, AN/ARN-7 RADIO COMPASS, AN/APS-13 TAIL WARNING RADAR	AN/ARC-3 COMMAND SET, SCR-695A IDENTIFICATION, BC-453B RANGE RECEIVER, AN/ARA-8 HOMING ADAPTER	AN/ARN-6 RADIO COMPASS, AN/ARC-3 COMMAND SET, BC-453B RANGE RECEIVER, R-122/ARN-12 MARKER BEACON AND INTERPHONE
CANOPY	MANUALLY OPERATED, SLIDING TYPE	MANUALLY OPERATED, SLIDING TYPE	ELECTRICALLY OR MANUALLY OPERATED, SLIDING TYPE
ARMOR	FIRE WALL AND BACK OF SEAT ARMOR, WINDSHIELD	FIRE WALL AND BACK OF SEAT ARMOR, WINDSHIELD	FIRE WALL AND ARMOR GLASS, WINDSHIELD
ANTI-G	ANTI-G SUIT CONNECTION	ANTI-G SUIT CONNECTION	NO ANTI-G SUIT CONNECTION
ENGINE	V-1650-9	V-1650-3, -7, OR -9A	V-1650-3 OR -7
WATER INJECTION SYSTEM	YES	NONE	NONE
HYDRAULIC SYSTEM	OPEN CENTER	CLOSED CENTER	CLOSED CENTER
COCKPIT ARRANGEMENT	SINGLE COCKPIT	SINGLE COCKPIT	FRONT AND REAR COCKPIT
GUN SIGHT	TYPE K-14A OR K-14B	TYPE K-14A, K-14B, OR N-9	NONE

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Figure 1-2

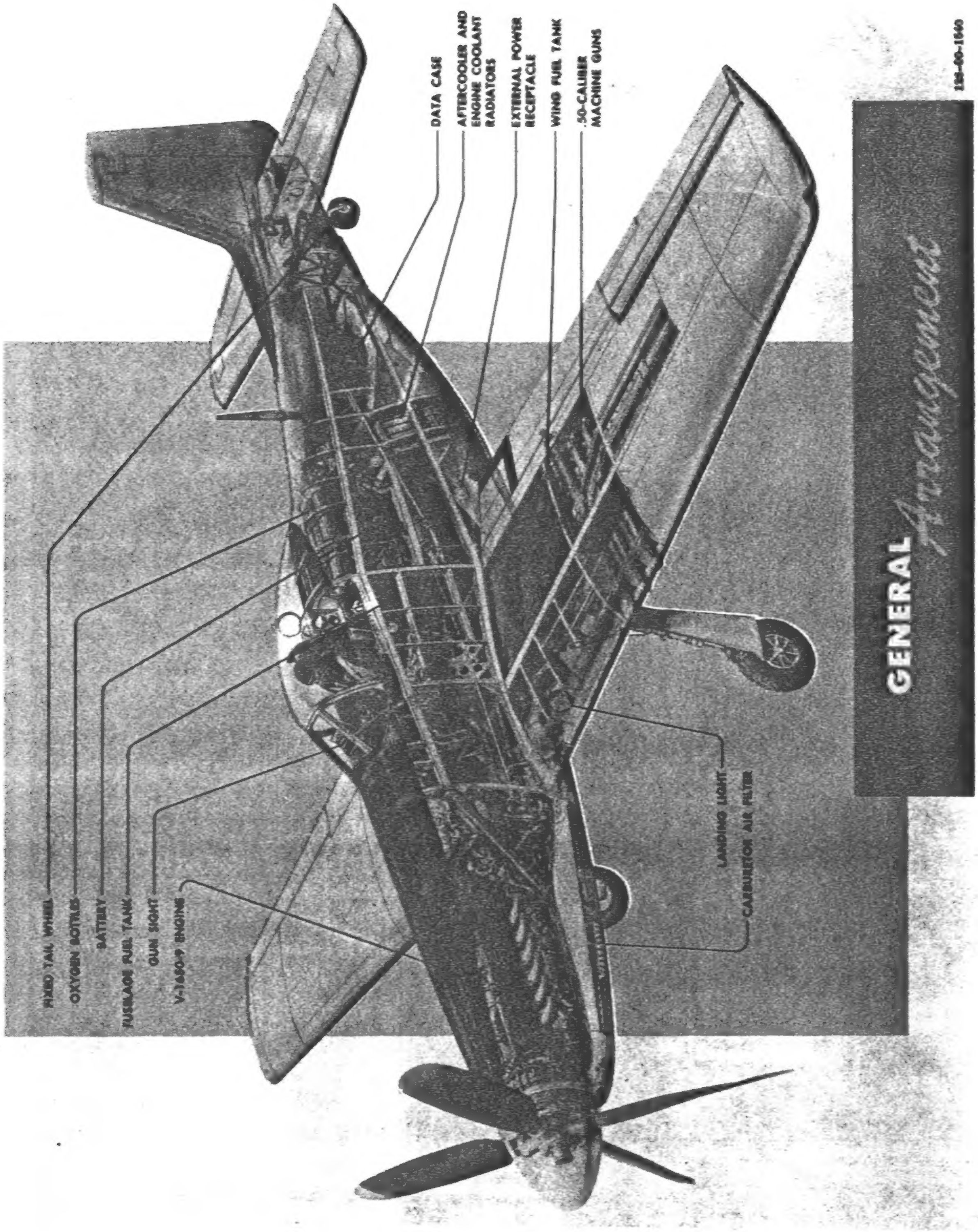

FIXED TAIL WHEEL
OXYGEN BOTTLES
BATTERY
FUSELAGE FUEL TANK
GUN SIGHT
V-1650-9 ENGINE
DATA CASE
AFTERCOOLER AND ENGINE COOLANT RADIATORS
EXTERNAL POWER RECEPTACLE
WING FUEL TANK
.50-CALIBER MACHINE GUNS
LANDING LIGHT
CARBURETOR AIR FILTER
GENERAL Arrangement

Figure 1-3

Cockpit

FORWARD VIEW

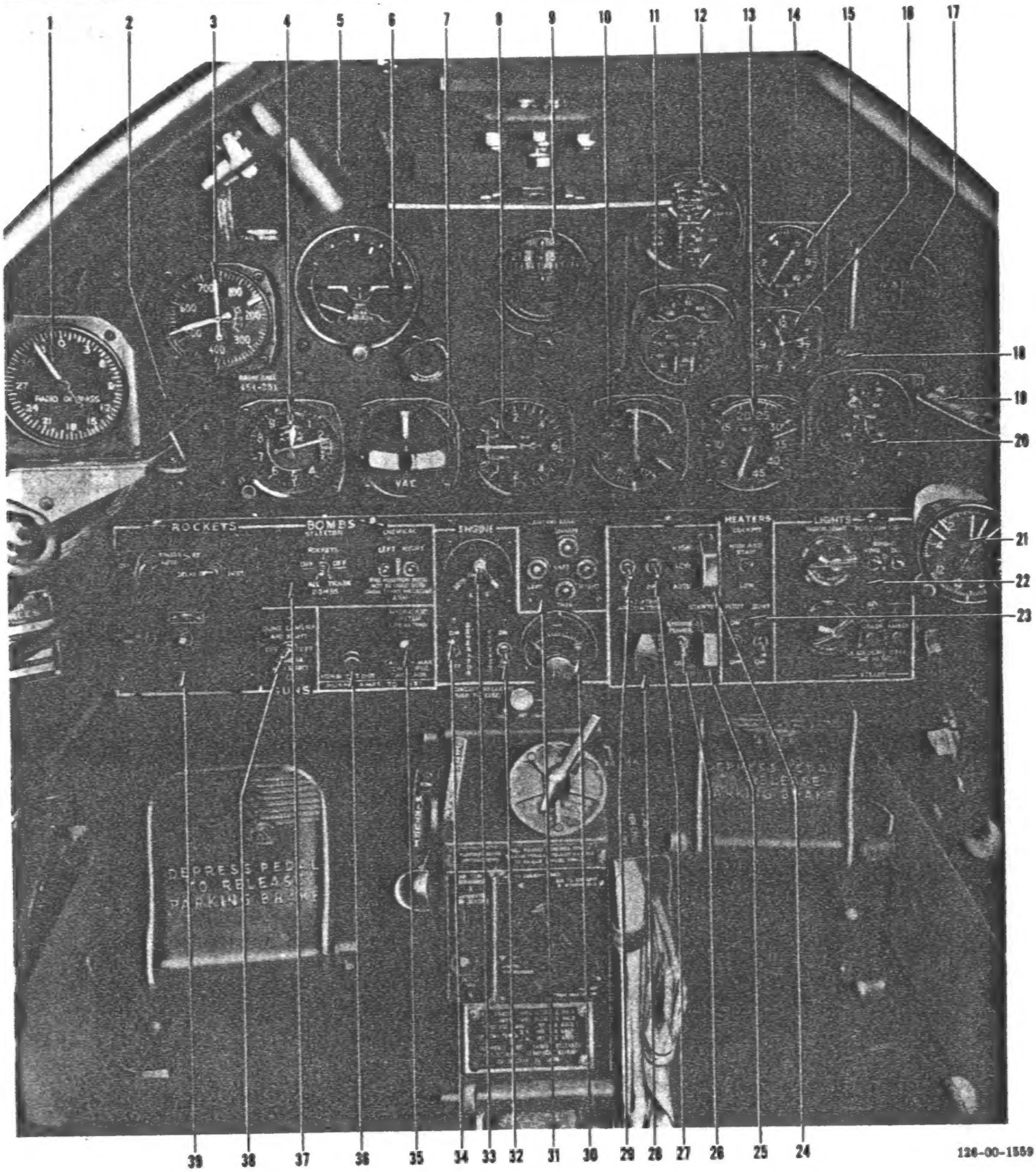
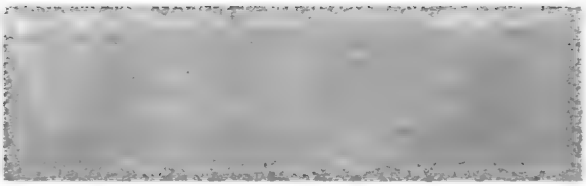


Figure 1-4 (Sheet 1 of 2)



1. Radio Compass Indicator (Some Airplanes)
2. Remote Compass Indicator
3. Airspeed Indicator
4. Altimeter
5. Fluorescent Light
6. Gyro Horizon
7. Turn-and-Bank Indicator
8. Rate-of-Climb Indicator
9. Directional Gyro
10. Manifold Pressure Gage
11. Engine Gage Unit
12. Fuel Quantity Gage
13. Tachometer
14. Recognition Light Key (disconnected)
15. Suction Gage
16. Clock
17. Stand-by Magnetic Compass
18. Manifold Pressure Drain Button
19. Canopy Emergency Release
20. Carburetor Air and Coolant Temperature Gage
21. Accelerometer
22. Light Switch Panel
23. Heater Switches
24. Supercharger Control Switch
25. Starter Switch
26. Engine Primer Switch
27. Oil Dilution Switch
28. Radiator Air Control Switch
29. Booster Pump Switch
30. Ammeter
31. Landing Gear Warning Lights
32. Battery-disconnect Switch
33. Ignition Switch
34. Generator-disconnect Switch
35. Hydraulic System Indicator Light
36. Landing Gear Warning Horn Cutout Button
37. Armament Switch Panel
38. Gun Safety Switch
39. Rocket Switch Panel

126-00-1590

Figure 1-4 (Sheet 2 of 2)

the carburetor to prevent a runaway engine when starting. A twist grip (10, figure 1-5) on the throttle operates the K-14 gun sight range compensator. A push-to-talk button for radio transmission is located on the end of the twist grip. A throttle locking lever (9, figure 1-5) is located on the face of the throttle quadrant to permit holding a desired setting. (See figure 1-8.)

MIXTURE CONTROL.

Early airplanes have a mixture control handle located on the left side of the cockpit, below the throttle quadrant; late airplanes have the mixture control handle (4, figure 1-7) located on the left side of the center control pedestal. The mixture control has two positions, IDLE CUTOFF and RUN. The carburetor is fully automatic and supplies the correct mixture for all operating conditions with the mixture control in the RUN position. No provision is made for manually leaning the mixture.

CAUTION

The mixture control should always be at IDLE CUTOFF position when the engine is not running, to prevent accumulation of fuel in the carburetor.

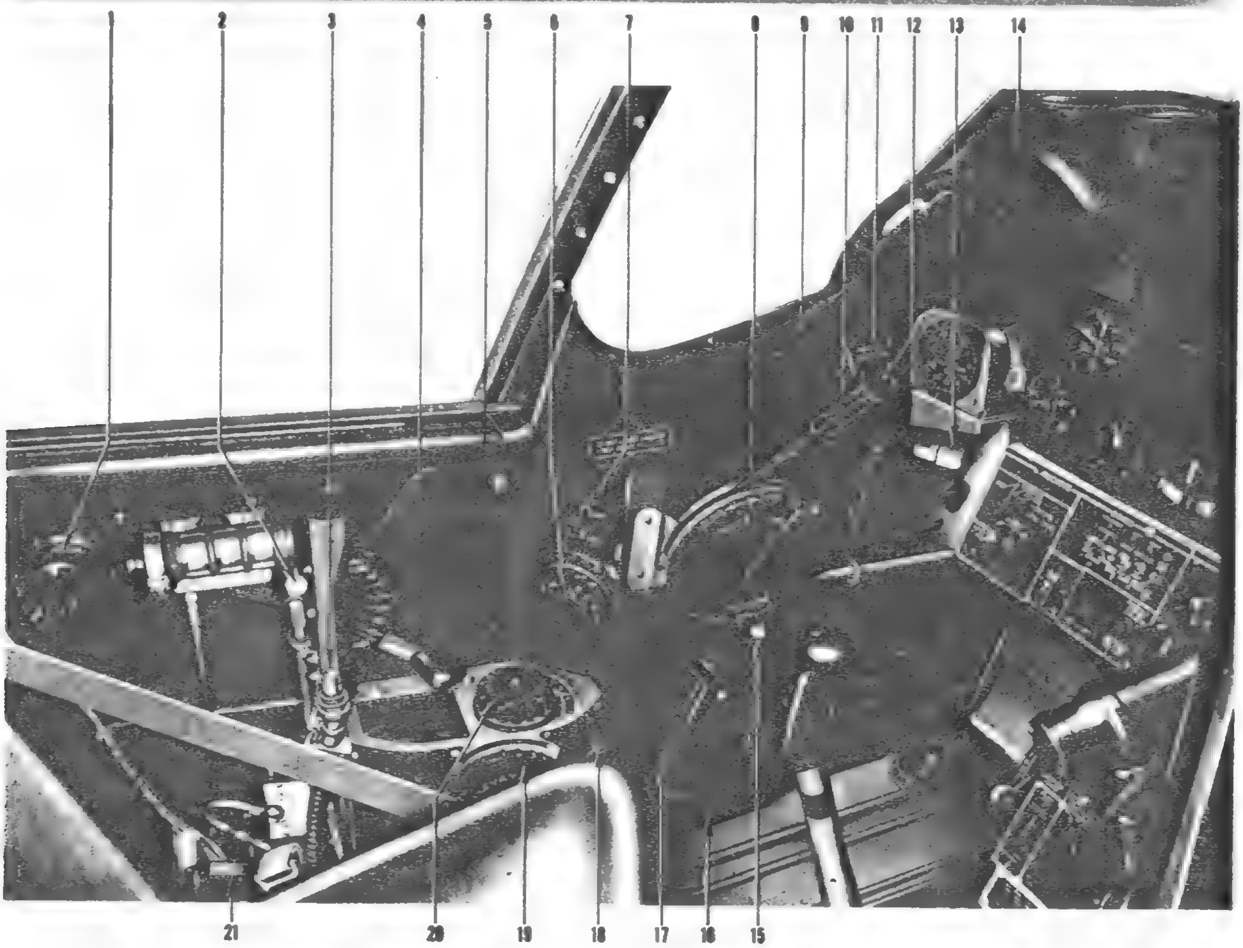
CARBURETOR AIR.

Cold outside ram air to the carburetor enters a duct in the nose just below the propeller spinner. (See figure 1-9.) A door at the forward end of the duct can be closed mechanically from the cockpit to force the air to enter through a perforated side panel (and filter) on each side of the engine cowl. For cold-weather operation, these perforated side panels can be replaced with blank panels. With blank panels installed, the induction system is forced to pull warm air from the engine compartment, through a spring-loaded door, whenever the ram-air door is closed. This spring-loaded door is also mechanically operated from the cockpit to permit warm air to enter as desired by the pilot. If at any time the ram-air duct becomes clogged with ice, warm air from the engine compartment is automatically admitted.

CARBURETOR AIR CONTROL LEVER.

The carburetor air control lever (12, figure 1-7), located on the right side of the cockpit floor, ahead of the seat, mechanically allows entry into the carburetor of ram air, unrammed filtered air, or warm unrammed air. When the control lever is in the COLD AIR RAMMED position (reached from the FILTERED AIR position when the carburetor air control lever is moved inboard and forward), cold ram air flows to the carburetor. When the control lever is in the HOT AIR UNRAMMED position (reached from the COLD AIR RAMMED position when the

Cockpit LEFT SIDE



1. Landing Gear Warning Horn
2. Side Air Outlet Control Knob
3. Anti-G Suit Connection
4. Wing Flap Handle
5. Armrest
6. Aileron Trim Tab Control Knob
7. Landing Light Switch
8. Throttle
9. Throttle Locking Lever
10. Gun Sight Twist Grip
11. Water Injection Switch
12. Microphone Button
13. Bomb (Tank) Salvo Levers
14. K-14 Gun Sight
15. Propeller Control
16. Gun Sight Selector-Dimmer Control Panel
17. Landing Gear Handle
18. Shoulder-harness Locking Handle
19. Elevator Trim Tab Control Wheel
20. Rudder Trim Tab Control Knob
21. Hydraulic Pressure Gage (For Ground Checks Only)

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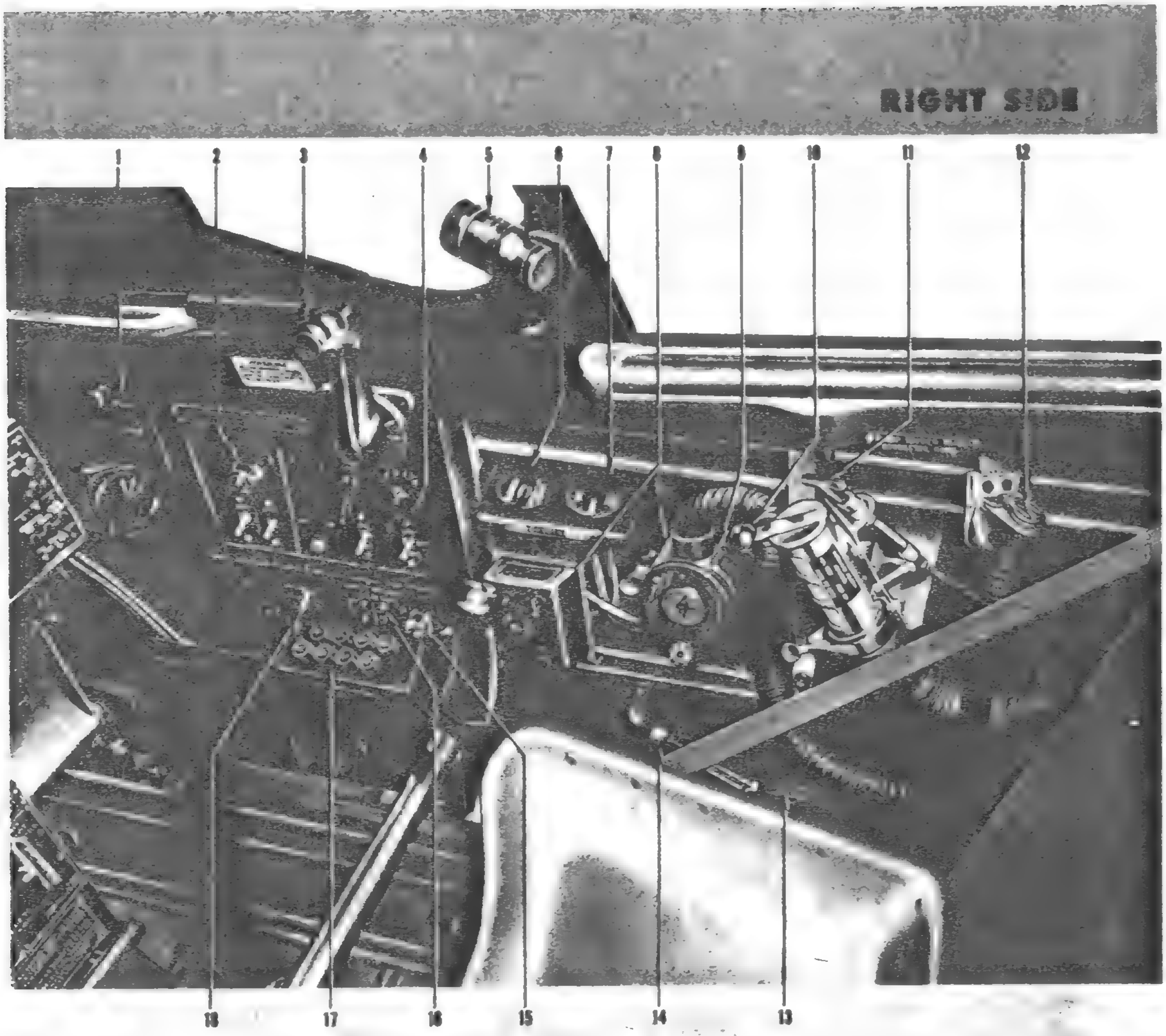
Figure 1-5



1. Spare Bulbs
2. Tail Warning Radar Panel
3. Canopy Crank
4. IFF Control Panel
5. Fluorescent Light
6. Oxygen Flow Indicator
7. Oxygen Pressure Gage
8. Range Receiver Control Box
9. Oxygen Regulator
10. Side Air Outlet Control Knob
11. Side Air Outlet Air Control Handle
12. Oxygen Hose
13. Map Case
14. Seat Adjustment Lever
15. VHF Volume Control
16. VHF Circuit Breakers
17. VHF Control Box
18. Homing Receiver Control Switch

120-31-303A

Figure 1-6

control lever is moved inboard and back to the FILTERED AIR position, then outboard and forward), warm unrammed air flows to the carburetor. When the control lever is in the FILTERED AIR position, air enters the induction system through two filter units in the forward section of the engine cowling.

WARNING

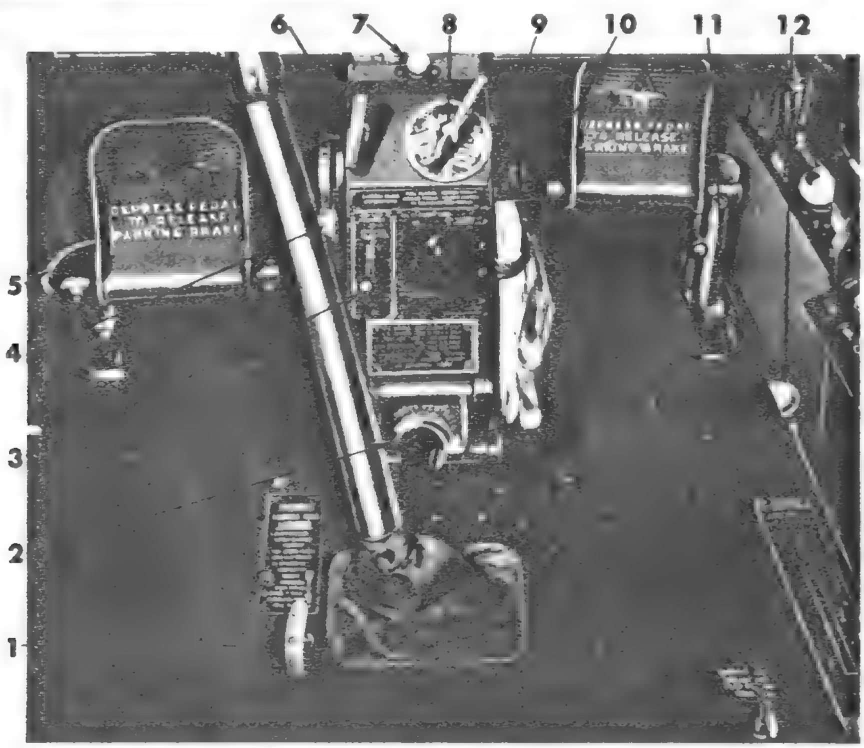
Because of adverse leaning effect, carburetor hot air should not be used above 12,000 feet altitude. The heat affects the altitude compensator of the carburetor.

COOLING SYSTEMS.

There are two complete and separate cooling systems used in this airplane. One system, the engine cooling system, is used to cool the engine. The other, the aftercooling system, cools the supercharged fuel-air mixture. Coolant from each system passes through its respective portion of the dual radiator, located in the aft portion of the air scoop on the underside of the fuselage. The radiator is actually two radiators constructed as a single unit with separate cores. An electrically controlled flap-type door is used to control the airflow through the radiator. In case of actuator failure, an emergency handle opens the coolant flap to lower the coolant temperature. The coolant solution consists of water and ethylene glycol in varying percentages depending on outside operating temperatures.

ENGINE COOLING SYSTEM. An engine-driven pump pressurizes the engine cooling system (figure 1-10), which has a capacity of 14.4 gallons including 2 gallons in the coolant header tank. The system may be filled at the coolant header tank, which is accessible through the dzus-fastened door at the forward end of the engine upper left cowling. (See figure 1-16.)

Pedestal AND *Lower Cockpit*



1. Landing Gear Emergency Release Handle
2. Surface Control Lock
3. Cockpit Air Temperature Lever
4. Mixture Control
5. Rudder Pedal Adjustment Lever (each pedal)
6. Parking Brake Handle
7. Circuit-breaker Reset Button
8. Fuel Selector Handle
9. Air Distribution Handle
10. Map Case
11. Coolant Air Flap Emergency Release Handle
12. Carburetor Air Control Lever

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Figure 1-7

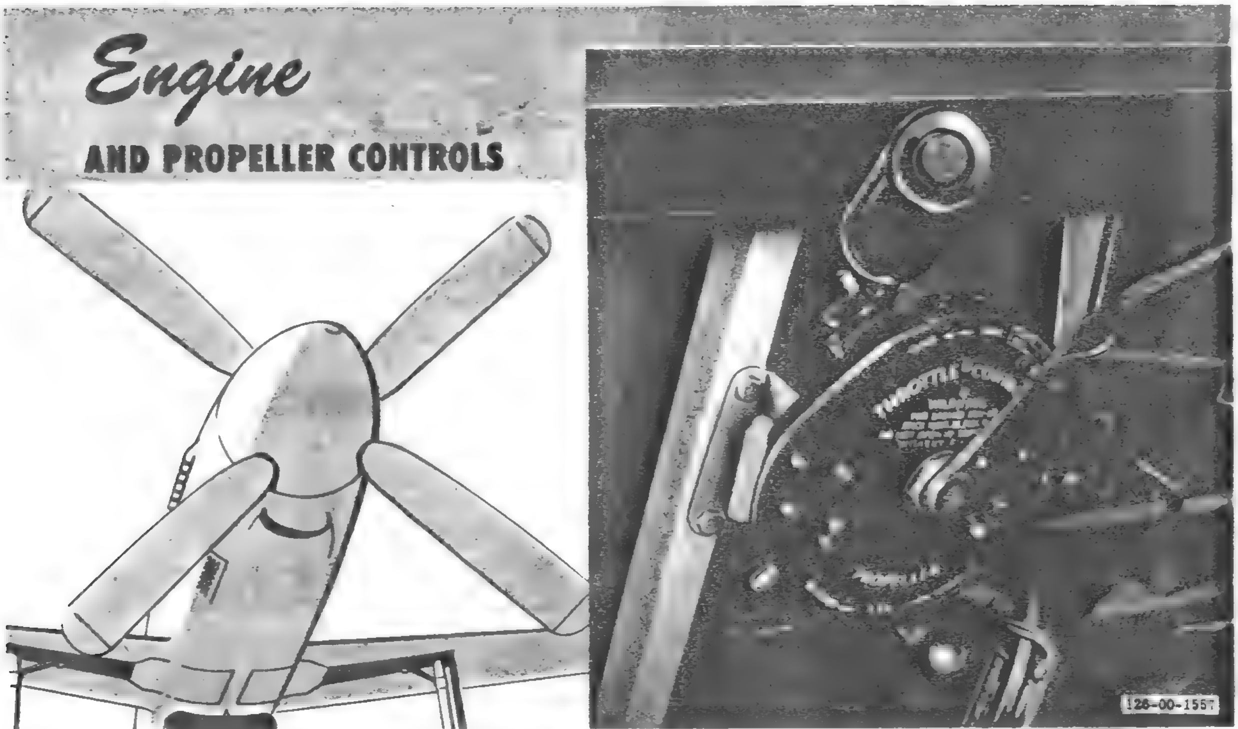


Figure 1-8

AFTERCOOLING SYSTEM. The aftercooling system (figure 1-10) is a low-pressure type and has a system capacity of 6.2 gallons. This capacity includes the aftercooling header tank, which contains one gallon. (See figure 1-16.) Coolant is forced by an engine-driven pump through the radiator to the supercharger cooling jackets, and from there returns to the aftercooler unit, cooling the fuel-air mixture before it enters the combustion chambers of the engine to minimize the possibility of detonation.

COOLANT FLAP CONTROL SWITCH.

Airflow through the dual radiator is controlled by an electric actuator which is mechanically connected to the coolant flap. The operation of the actuator is controlled by a switch (28, figure 1-4) located on the right side of the front switch panel. The switch has four positions: AUTOMATIC, OPEN, CLOSE, and OFF. The AUTOMATIC position is used for normal operation; the switch is held in this position by a spring-loaded guard. With the switch in this position, the temperature of the coolant governs the amount the coolant flap will be opened or closed. From the spring-loaded OPEN or CLOSE position, the switch returns to OFF when released. These two positions permit the pilot to open and close the coolant flap as desired during ground operation or if manual adjustment is necessary during flight. For all ground operation, the switch should be held at OPEN until the coolant flap is fully opened, then should be released to OFF.

COOLANT FLAP EMERGENCY RELEASE HANDLE.

A manual coolant flap emergency release handle (11, figure 1-7) is located on the floor of the cockpit, to the right of the seat. In case of actuator failure, a quick pull of this handle mechanically extends the coolant flap an additional 5½ inches by increasing the length of the linkage to the coolant flap. If the coolant flap is completely closed, the flap will open to a minimum of 7 inches. After the coolant flap emergency release handle has been pulled, there is no means of resetting it in flight, nor is there any emergency means of closing the flap.

SUPERCHARGER.

The engine-driven, two-speed, two-stage supercharger is of the centrifugal type automatically controlled by a dual-element aneroid-type pressure switch vented to the carburetor intake pressure. One element of the aneroid switch is calibrated to give best performance at Military Power. The other element is controlled by the water injection switch and is calibrated to give best

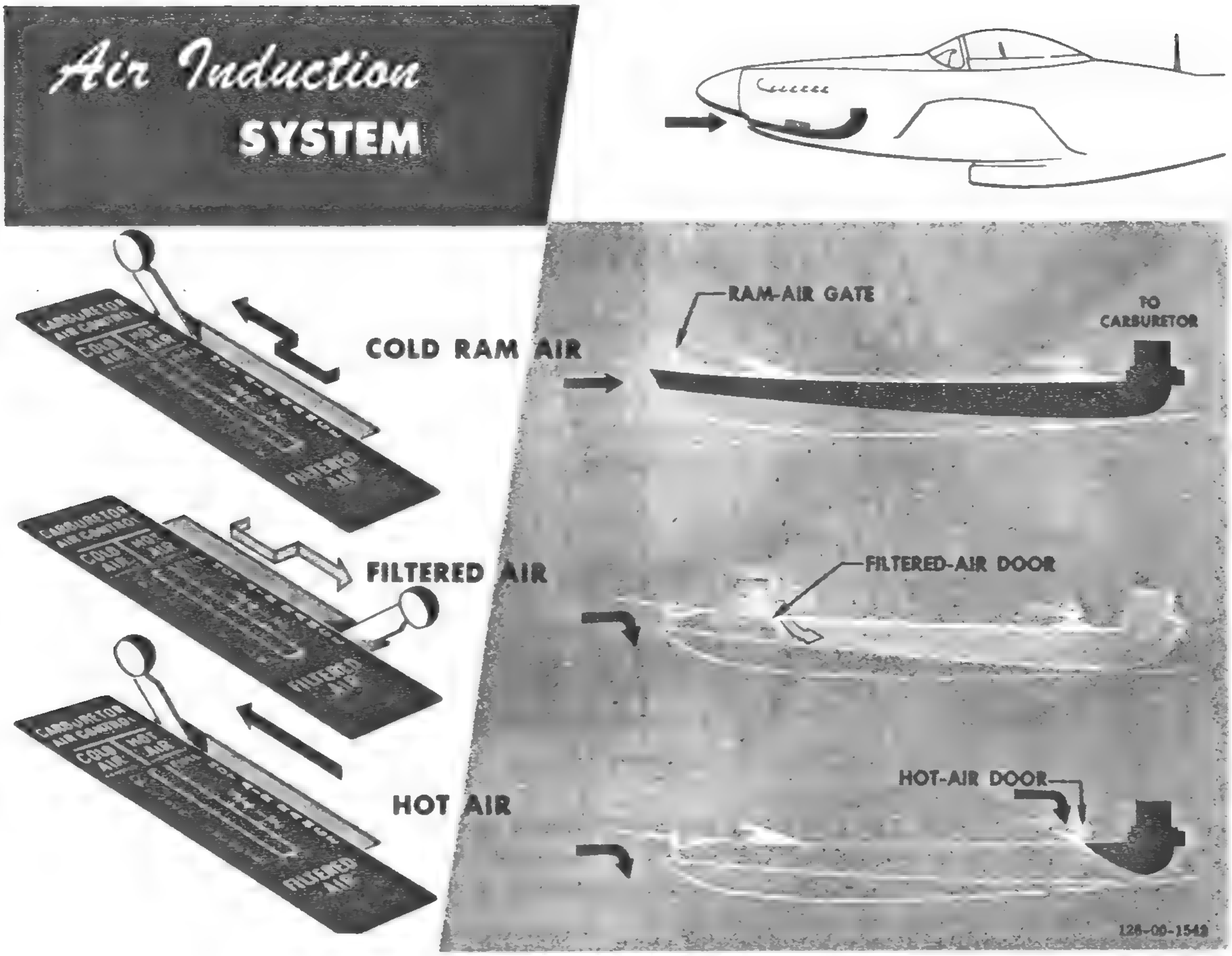


Figure 1-9

performance at War Emergency Power. At powers below War Emergency Power, with the supercharger control switch at AUTO, the aneroid switch changes the blower speed from low to high at the altitude for best performance at Military Power. It is calibrated to shift the supercharger to high blower between 20,900 and 24,900 feet airplane altitude, depending on airspeed. To prevent excessively frequent blower speed changes resulting from small speed or altitude changes near shift altitude, the aneroid switch is constructed so that the shift downward from high to low speed occurs approximately 1300 feet below the upward shift point during a normal descent. However, during a dive or rapid descent, the shift downward may occur at or above the upward shift point because of the increase in ram-air pressure at the carburetor air intake due to the higher airspeed.

Note

In flight, the blower may shift at altitudes other than specified in the preceding paragraph. This condition is normal, since the blower shift aneroid is referenced to carburetor entrance air pressure, which increases with indicated airspeed. Differences in airplane altitude at the time of blower shift are due to the ram-air variations in climb, level flight, and descent.

For minimum fuel consumption on long-range cruising operations, it is advantageous to remain in low blower speed above the altitude of shift. The ranges shown on the charts in Appendix I are possible only when proper supercharger speed is used. In case of blower shift aneroid failure, the supercharger automatically returns to low speed.

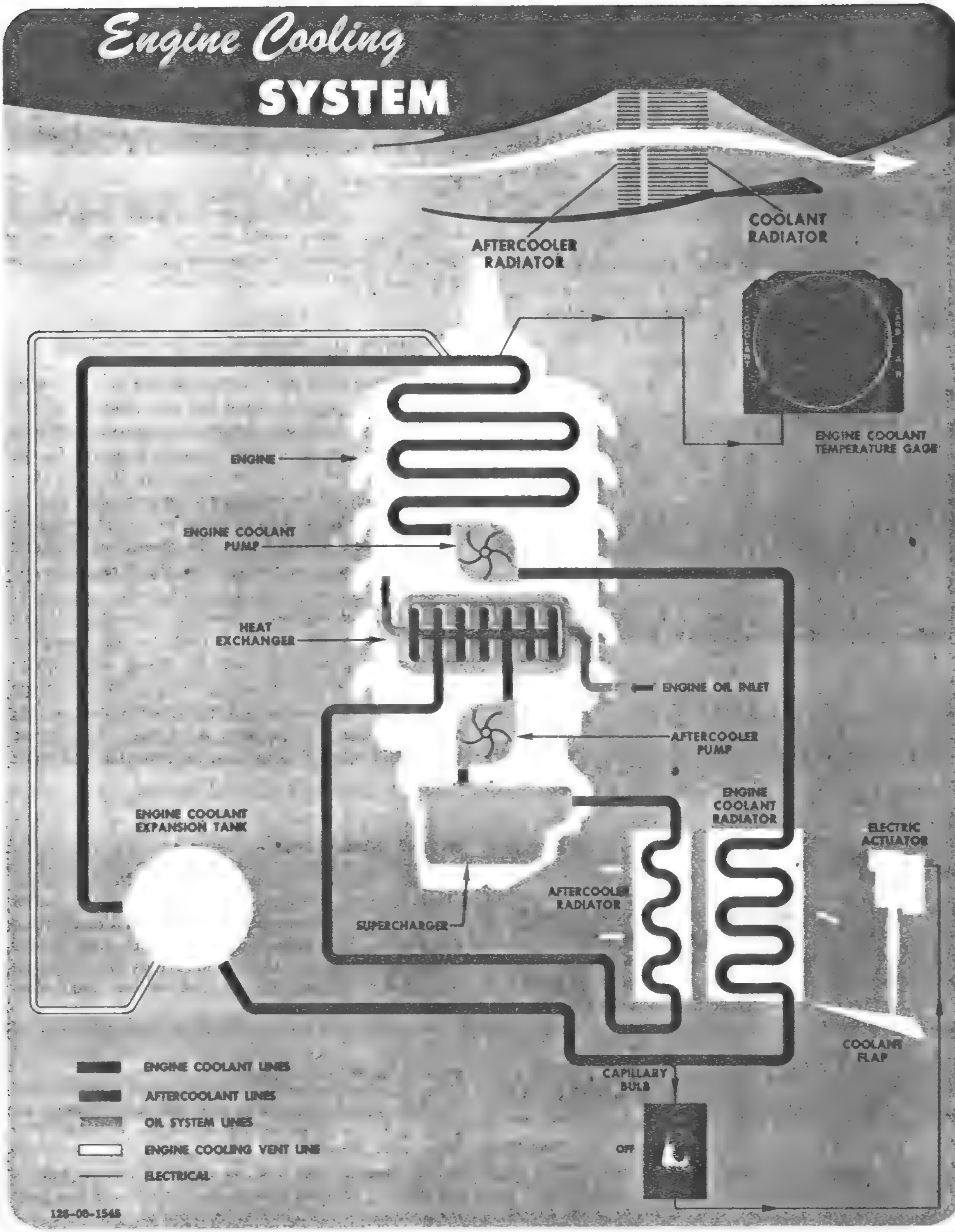

Engine Cooling
SYSTEM
AFTERCOOLER RADIATOR
COOLANT RADIATOR
ENGINE COOLANT TEMPERATURE GAGE
ENGINE
ENGINE COOLANT PUMP
HEAT EXCHANGER
ENGINE OIL INLET
AFTERCOOLER PUMP
ENGINE COOLANT EXPANSION TANK
ENGINE COOLANT RADIATOR
ELECTRIC ACTUATOR
AFTERCOOLER RADIATOR
SUPERCHARGER
COOLANT FLAP
CAPILLARY BULB
OFF
ENGINE COOLANT LINES
AFTERCOOLANT LINES
OIL SYSTEM LINES
ENGINE COOLING VENT LINE
ELECTRICAL
128-00-1545

Figure 1-10

SUPERCHARGER CONTROL SWITCH.

The supercharger control switch (24, figure 1-4), located on the right side of the front switch panel, has three positions: LOW, AUTO, and HIGH. A spring-loaded guard holds the switch in the AUTO position. When the switch is at the AUTO position, the supercharger is controlled by the electrical dual-element aneroid-type pressure switch vented to the carburetor intake pressure. For all normal operation, the switch should be at AUTO. The LOW position is used to open the circuit to the supercharger solenoid for low-blower operation in the event the aneroid switch fails. The HIGH position permits shifting to high blower below the preset shift altitude and to operate high blower for ground checks.

IGNITION SYSTEM.

Two engine-driven, high-tension magnetos, mounted on the engine, supply spark for combustion and are grounded when the ignition system is inoperative. Both magnetos have booster coil connections, but only the one on the right magneto is used. The booster coil intensifies the spark of the right magneto to aid starting.

IGNITION SWITCH.

The ignition switch (33, figure 1-4) is located on the front switch panel and has four positions, OFF, R, L, and BOTH.

CAUTION

To prevent accidental engine start, be sure ignition switch is moved to OFF after stopping engine.

PRIMER SYSTEM.

The electrically energized priming system gets its fuel from the engine-driven fuel pump and consists of a primer, solenoid valve, momentary-on switch, and connections to the induction manifold. Holding the primer switch ON for one second is equivalent to one stroke of a manual primer.

PRIMER SWITCH.

The primer switch (26, figure 1-4) is located on the front switch panel and has two positions, OFF and momentary ON. When the primer switch is held ON, the solenoid valve mounted on the carburetor permits fuel to pass to the primer lines and into the induction manifold. Usually 3 or 4 seconds is sufficient to prime a cold engine. The engine should be primed only when it is turning over.

STARTER SYSTEM.

The starter system consists of an electric direct-cranking starter, a starter switch, and a booster coil. To aid the magnetos when rpm is low during cranking, a booster coil intensifies the spark of the right magneto which fires the intake spark plug of each cylinder.

STARTER SWITCH.

The starter switch (25, figure 1-4; figure 4-8) located on the front switch panel, has an ON position and a spring-loaded guarded OFF position. Holding the switch at ON energizes both the starter and the booster coil.

AUTOMATIC MANIFOLD PRESSURE REGULATOR.

The Simmonds automatic engine control unit, mounted on the supercharger housing and using engine oil for operation, automatically maintains a constant manifold pressure at all power settings between 25 and 67 in. Hg up to the critical altitude of the engine. If at any time the operating oil to the control unit should fail, the unit becomes fully manual over the entire range of manifold pressure available. The maximum available at this time is approximately 52 in. Hg. A manual override is mechanically linked to the control unit from the throttle to manually close the butterfly valve to prevent a runaway engine during starting. Stopping and starting procedures must be strictly followed to prevent runaway engine during starting. The advantage of the automatic control unit in constantly maintaining a selected manifold pressure more than compensates for the difficulty of carburetor ice detection and strict stopping and starting procedures.

ENGINE INDICATORS.

Standard engine instruments are provided in the airplane. The oil pressure, fuel pressure, and manifold pressure gages indicate pressure readings directly from the engine. The tachometer is self-generated. Power from the airplane electrical system is required to operate the oil temperature, coolant temperature, and carburetor temperature indicators.

WATER INJECTION SYSTEM.

A water injection system is incorporated to enable engine operation at 80 in. Hg manifold pressure (War Emergency Power—Wet). The system includes a 10-gallon water-alcohol tank, an electric pump, a pressure regulator, a pressure switch, and a water pressure gage for ground checks. The system is put in operation from the cockpit by use of the throttle and a water injection switch. When the system is in operation, the coolant

flap actuator control automatically shifts to the high-temperature band and the manifold pressure regulator is automatically reset to permit the higher manifold pressure. After the water injection switch closes the circuit, the system is fully automatic. When the throttle is advanced through the gate, breaking the safety wire, the throttle microswitch completes the circuit and the water-alcohol mixture is injected with the fuel at the fuel discharge nozzle in the carburetor. Operation of the water injection system is limited to approximately 7 minutes because of water supply. When the water supply is exhausted, the water pressure drops, causing the pressure switch to open the circuit. The manifold pressure regulator then resumes normal operation of 67 in. Hg manifold pressure for War Emergency Power —Dry.

WATER INJECTION SWITCH.

The water injection switch (11, figure 1-5), located on the left longeron above the throttle quadrant, has ON and OFF positions. When the switch is moved to ON, the water injection system is ready for operation and is fully automatic. The system automatically shuts off when the water supply is exhausted. If the throttle is retarded, then returned to War Emergency Power position after the water supply is exhausted, a momentary surge of manifold pressure will result on late airplanes.*

WARNING

On late airplanes,* be sure water injection switch is moved to OFF after water supply is exhausted; otherwise, damage to engine may result when the throttle is advanced to War Emergency Power.

PROPELLER.

The engine drives an 11-foot 1-inch diameter, four-bladed, constant-speed Aeroproducts propeller. A propeller control in the cockpit mechanically controls a governor contained in the propeller to select and hold a desired rpm. The governor will maintain a selected rpm regardless of varying air loads or flight attitudes by directing pressurized oil from the integral reservoir to a piston in each blade. The governor, oil pump, and oil supply are all contained within a regulator assembly on the back of the propeller hub.

PROPELLER CONTROL.

A propeller control (15, figure 1-5), located on the throttle quadrant, is mechanically linked to the propeller governor. The control setting determines the engine rpm, which is maintained constant by the propeller governor. The propeller control may be positioned at INCREASE or DECREASE, or to any intermediate position.

OIL SYSTEM.

Engine lubrication is accomplished by a dry-sump, pressure-type system. A 13.75-gallon oil tank with a 2.25-gallon expansion space supplies the engine-driven oil pump. The oil passes through a filter and oil pressure relief valve before being distributed to various parts of the engine. After lubricating the necessary parts of the engine, the oil flows to the engine sump; the scavenge pump then forces it through a heat exchanger. A thermostatically controlled valve on the heat exchanger either routes the oil through the core to be cooled or by-passes the core so that the oil goes directly to the oil tank. The coolant passing through the heat exchanger is cooled in the aftercooler section of the coolant radiator. See figure 1-16 for oil grade and specification. A dip-stick type gage, used to measure the amount of oil in the tank, is located adjacent to the filler neck. An oil dilution system is provided to facilitate cold-weather starting.

OIL DILUTION SWITCH.

An oil dilution switch (27, figure 1-4), located on the front switch panel, actuates the oil dilution solenoid, permitting fuel from the engine-driven fuel pump to enter the oil system. This switch is spring-loaded to OFF, and must be held ON for oil dilution.

Note

The oil dilution period must be held to a maximum of 3 minutes to prevent failure of oil scavenge system.

OIL SYSTEM INDICATORS.

An engine gage unit (11, figure 1-4), installed on the instrument panel, gives oil temperature and oil pressure.

FUEL SYSTEM.

The fuel system (figure 1-11) consists of three self-sealing tanks: one in each wing, and a fuselage tank. The right wing tank and fuselage tank have their own gravity-fed electric submerged-type booster pumps receiving power from the electrical system of the airplane. The left wing tank has no booster pump. Fuel from the left wing tank flows by gravity to the right wing tank

*F-51H-10 Airplanes AF44-64688 and subsequent

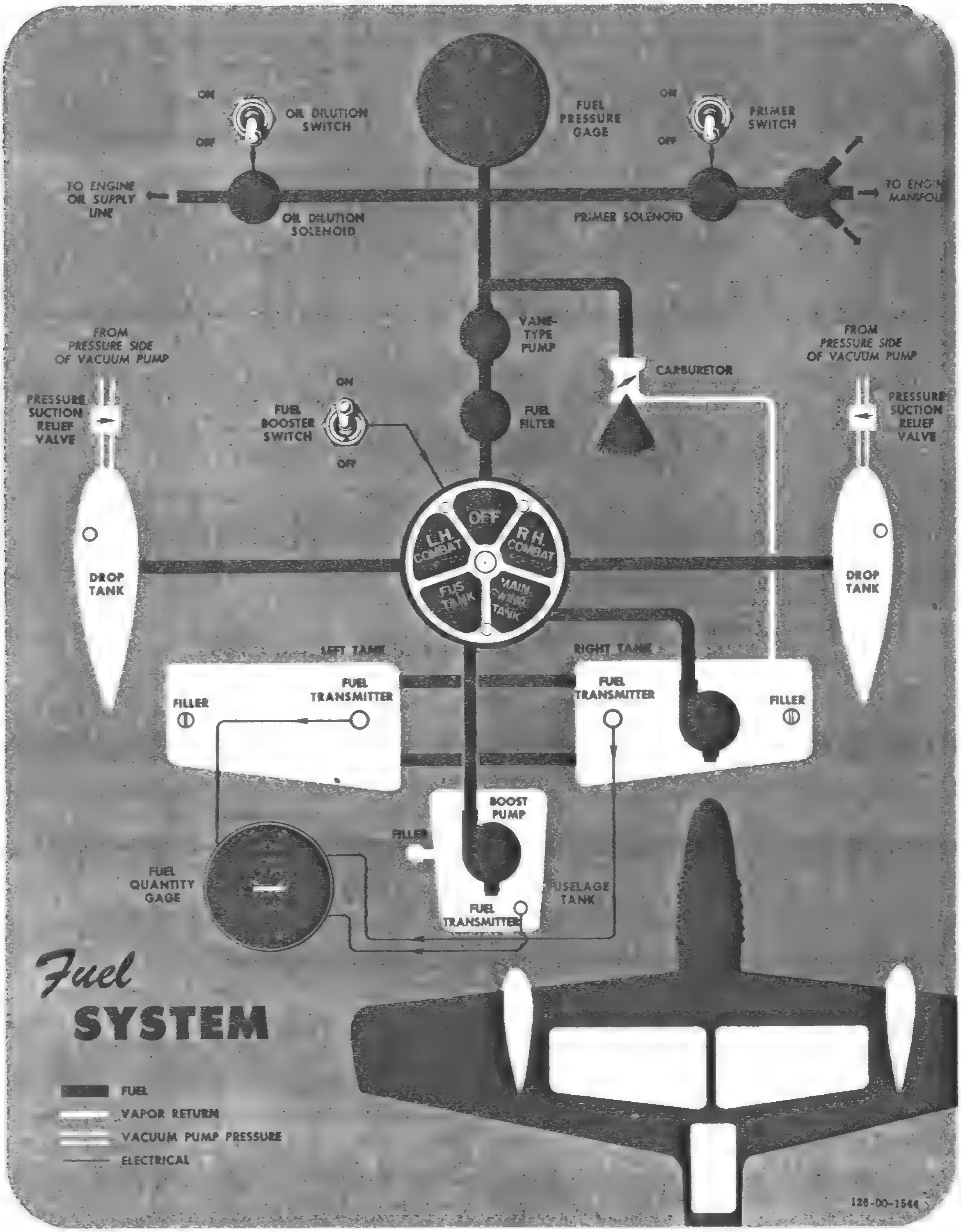

ON
OIL DILUTION SWITCH
OFF
FUEL PRESSURE GAGE
ON
PRIMER SWITCH
OFF
TO ENGINE OIL SUPPLY LINE
OIL DILUTION SOLENOID
PRIMER SOLENOID
TO ENGINE MANIFOLD
VANE-TYPE PUMP
CARBURETOR
FROM PRESSURE SIDE OF VACUUM PUMP
FROM PRESSURE SIDE OF VACUUM PUMP
PRESSURE SUCTION RELIEF VALVE
PRESSURE SUCTION RELIEF VALVE
ON
FUEL BOOSTER SWITCH
OFF
FUEL FILTER
OFF
L.H. COMBAT
R.H. COMBAT
FUS TANK
MAIN WING TANK
DROP TANK
DROP TANK
LEFT TANK
RIGHT TANK
FILLER
FUEL TRANSMITTER
FUEL TRANSMITTER
FILLER
BOOST PUMP
FILLER
FUEL QUANTITY GAGE
FUSELAGE TANK
FUEL TRANSMITTER
Fuel SYSTEM
FUEL
VAPOR RETURN
VACUUM PUMP PRESSURE
ELECTRICAL
128-00-1544

Figure 1-11

through check valves. The booster pumps supplement the engine-driven fuel pump and will handle the fuel needs of the engine at all altitudes if the engine-driven fuel pump fails. If the booster pumps fail, the engine-driven fuel pump will supply fuel only up to approximately 8500 feet. There are provisions beneath each wing for carrying either two 75-gallon, two 110-gallon, or two 165-gallon drop tanks.

Caution

If installation of 165-gallon drop tanks is necessary to accomplish a particular mission, accelerated maneuvers are limited to those absolutely necessary to conduct normal flight, because of possible structural failure.

The drop tanks have no booster pumps, but fuel is forced from them by a controlled pressure of 5 psi from the exhaust side of the vacuum pump. This pressurization will permit satisfactory flow of fuel from the drop tanks at all altitudes. If the pressure to the drop tanks fails, the engine-driven fuel pump is capable of pulling fuel from the drop tanks up to 10,000 feet. See figure 1-12 for fuel quantity data and figure 1-16 for fuel grade and specification.

FUEL SYSTEM CONTROLS AND INDICATOR.

FUEL TANK SELECTOR HANDLE.

The fuel tank selector handle (8, figure 1-7) is located below the instrument panel, on the pedestal. The handle is mechanically connected to the fuel selector valve, mounted between the rudder pedals below the cockpit floor, and has the following positions marked on the mounting plate: OFF, R.H. COMBAT DROP TANK, MAIN WING TANKS, FUS. TANK, and L.H. COMBAT DROP TANK.

Fuel Quantity
DATA

US. GALLONS

	NO	USABLE FUEL IN LEVEL FLIGHT (EACH)	[illegible] SERVICED (EACH)	EXPANSION SPACE (EACH)	[illegible] (EACH)
LH MAIN	1	106	107	3	110
RH MAIN	1	104	104	3	107
FUSELAGE	1	50	51	6	57
DROP TANKS	2 OR	75	75	2	77
	2 OR	110	110	3	113
	2	165	165	5	170

Total usable internal fuel, 260 gallons.
Total usable fuel with 75-gallon drop tanks, 410 gallons.
Total usable fuel with 110-gallon drop tanks, 480 gallons.
Total usable fuel with 165-gallon drop tanks, 590 gallons.

136-06-1541

Figure 1-12

With the fuel selector handle at OFF, the selector acts as a fuel shutoff valve. A switch incorporated in the selector handle assembly is connected in series with the booster pump switch and will start the booster pump in the tank selected, provided the fuel booster pump switch is ON. The booster pump in the tank not actually supplying fuel is automatically shut off.

FUEL BOOSTER PUMP SWITCH.

A fuel booster pump switch (29, figure 1-4), located in the center of the front switch panel, is wired in series with the fuel selector electrical system. The switch has ON and OFF positions and must be in the ON position before the booster pumps will operate.

BOMB OR DROP TANK SALVO LEVERS.

The drop tanks can be released whenever desired by pulling the two bomb tank salvo levers (13, figure 1-5) located on the left side of the cockpit, by the front switch panel. The bomb tank salvo levers provide a selective mechanical release of the drop tanks or bombs independent of the electrical bomb release system.

FUEL QUANTITY GAGE.

Fuel quantity in the individual tanks is indicated by a single gage (12, figure 1-4), located on the instrument panel. The single gage has three individual pointers, which show the fuel quantity in their respective tanks.

The battery-disconnect switch must be ON before the indicators will operate. No fuel quantity gages are installed for the drop tanks.

ELECTRICAL POWER SUPPLY SYSTEM.

The 28-volt direct-current electrical system (figure 1-13) receives power from a 28-volt, 100-ampere, engine-driven generator. A 24-volt storage battery supplies current when the generator output is less than 26.5 volts. An external power receptacle is located on the left side of the fuselage, just behind the cockpit. An external power source (C-13A or equivalent) instead of battery power should be used on the ground to start the engine or to operate the electrical system when the engine is shut down.

CAUTION

The polarity of the external power must be the same as that of the airplane.

An inverter supplies 400-cycle, 26-volt alternating current for operation of the remote-reading compass. The inverter receives its power directly from the battery whenever the battery-disconnect switch is ON.

CIRCUIT BREAKERS.

All electrical circuits in the airplane are protected either by manual reset or automatic circuit breakers. A mechanically operated circuit-breaker reset button (7, figure 1-7), located in the center of the front switch panel, resets all open manual reset circuit breakers when pushed.

ELECTRICALLY OPERATED EQUIPMENT.

See figure 1-13.

ELECTRICAL POWER SUPPLY SYSTEM CONTROLS AND INDICATOR.

BATTERY-DISCONNECT SWITCH.

A battery-disconnect switch (32, figure 1-4), located in the center of the front switch panel, has an ON and an OFF position and allows battery power to be supplied to the airplane electrical system. The switch should be in the OFF position when external power is used for starting, to conserve the battery. When the engine is operating and external power is disconnected, the battery-disconnect switch should be placed in the ON position. The switch should always be placed in the OFF position upon leaving the airplane.

GENERATOR-DISCONNECT SWITCH.

The generator-disconnect switch (34, figure 1-4), located directly to the left of the battery-disconnect switch, has ON and OFF positions. With the switch in the OFF position, generator power output is not available to the airplane electrical system. The generator "cut-in" speed is about 1200 rpm, and power output is available when the generator-disconnect switch is at ON. On some airplanes, a spring-loaded guard holds the switch at ON, while on other airplanes the switch is safetied ON. The switch should not be moved to OFF except when necessary for maintenance.

AMMETER.

An ammeter (30, figure 1-4), located on the lower section of the right switch panel, is calibrated for a maximum reading of 150 amperes. The ammeter indicates the amount of current being supplied by the generator, and its reading increases each time an additional electrical unit is used. The maximum allowable amperage is 100, and this should be indicated only for a short period of time.

HYDRAULIC POWER SUPPLY SYSTEM.

The hydraulic power supply system (figure 1-14) is an open-center system that is used to operate the landing gear and wing flaps. The hydraulic system operates at a normal pressure of 1750 ($\pm$50) psi. Since the system is an open-center type, after completion of any hydraulic operation, the respective control handle must be left in the neutral position to relieve the engine-driven hydraulic pump of continuous operation against pressure. Although the wheel brakes have a separate hydraulic system, they derive hydraulic oil for their operation from the hydraulic reservoir.

CAUTION

- On early airplanes, the landing gear handle must be in NEUTRAL before the wing flaps will operate. Later airplanes permit the wing flaps to be operated when the landing gear handle is at UP or DOWN.
- During wing flap operation, no pressure to the landing gear is available until the wing flap handle is released.

HYDRAULIC SYSTEM INDICATOR LIGHT.

An amber indicating light (35, figure 1-4), located on the front switch panel, illuminates when pressure builds up to approximately 1500 psi following operation of

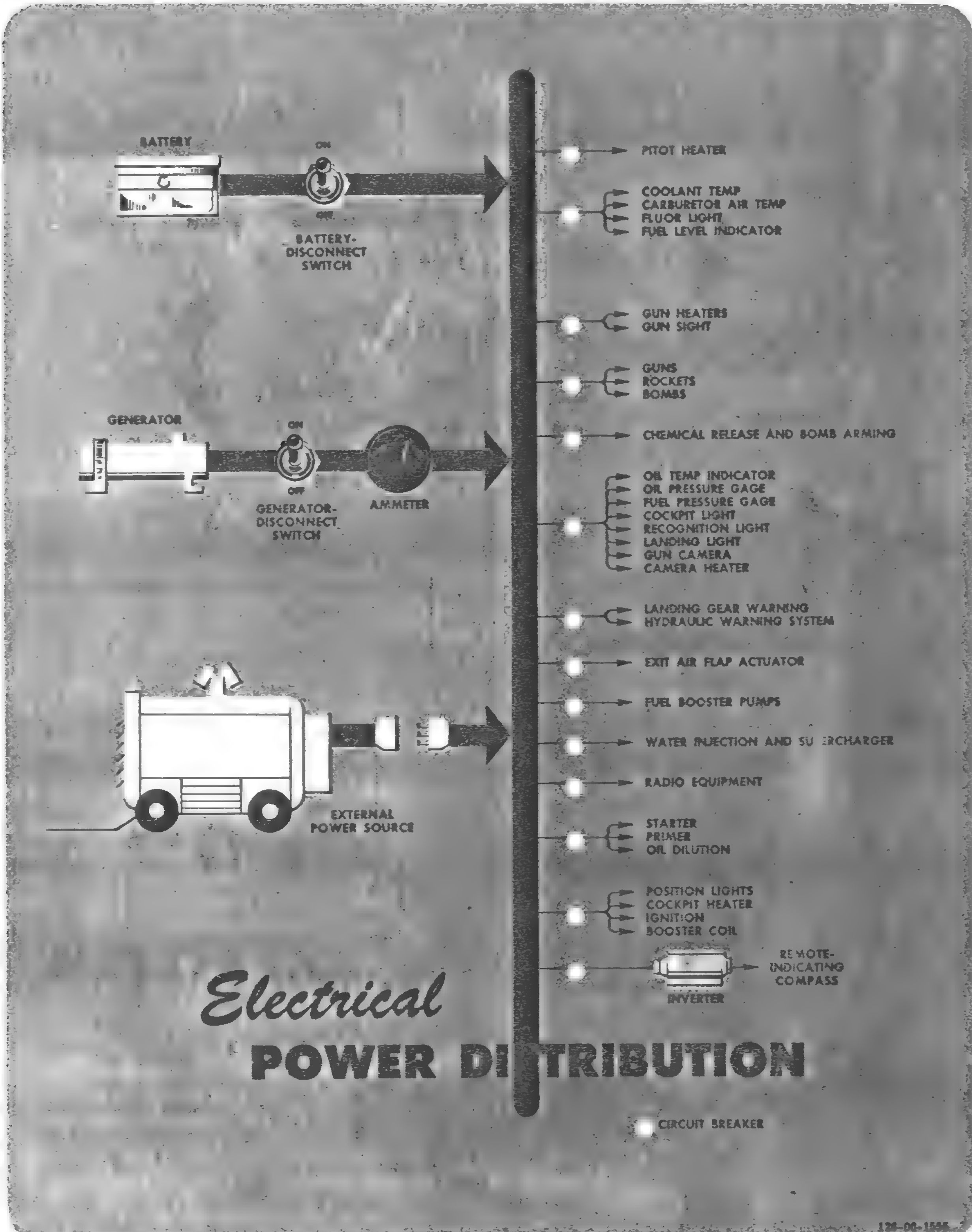

BATTERY
ON
OFF
BATTERY-DISCONNECT SWITCH
GENERATOR
ON
OFF
GENERATOR-DISCONNECT SWITCH
AMMETER
EXTERNAL POWER SOURCE
PITOT HEATER
COOLANT TEMP
CARBURETOR AIR TEMP
FLUOR LIGHT
FUEL LEVEL INDICATOR
GUN HEATERS
GUN SIGHT
GUNS
ROCKETS
BOMBS
CHEMICAL RELEASE AND BOMB ARMING
OIL TEMP INDICATOR
OIL PRESSURE GAGE
FUEL PRESSURE GAGE
COCKPIT LIGHT
RECOGNITION LIGHT
LANDING LIGHT
GUN CAMERA
CAMERA HEATER
LANDING GEAR WARNING
HYDRAULIC WARNING SYSTEM
EXIT AIR FLAP ACTUATOR
FUEL BOOSTER PUMPS
WATER INJECTION AND SU ERCHARGER
RADIO EQUIPMENT
STARTER
PRIMER
OIL DILUTION
POSITION LIGHTS
COCKPIT HEATER
IGNITION
BOOSTER COIL
INVERTER
REMOTE-INDICATING COMPASS
Electrical
POWER DI TRIBUTION
CIRCUIT BREAKER

Figure 1-13

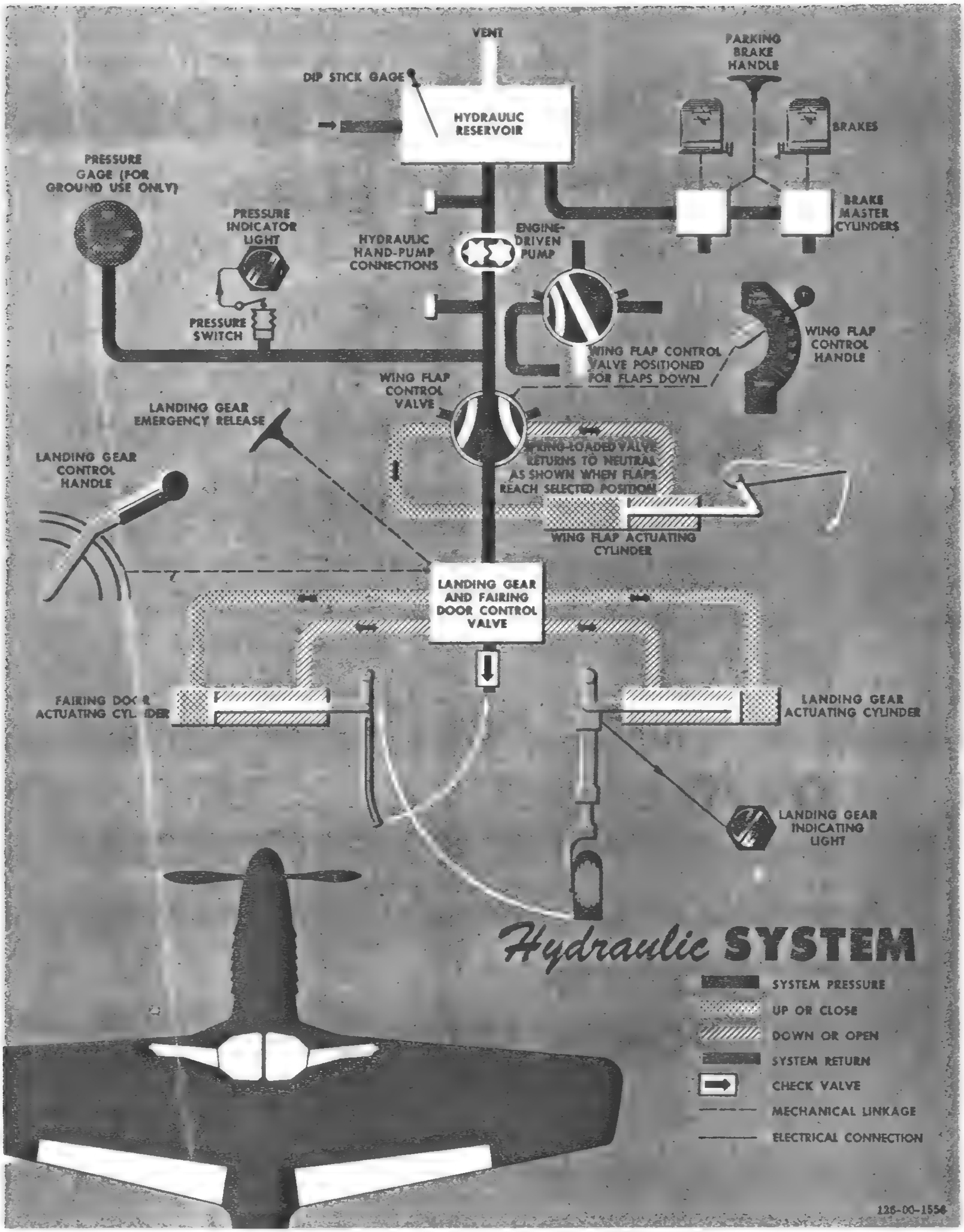

VENT
DIP STICK GAGE
HYDRAULIC RESERVOIR
PARKING BRAKE HANDLE
BRAKES
BRAKE MASTER CYLINDERS
PRESSURE GAGE (FOR GROUND USE ONLY)
PRESSURE INDICATOR LIGHT
HYDRAULIC HAND-PUMP CONNECTIONS
ENGINE-DRIVEN PUMP
PRESSURE SWITCH
WING FLAP CONTROL VALVE POSITIONED FOR FLAPS DOWN
WING FLAP CONTROL HANDLE
WING FLAP CONTROL VALVE
LANDING GEAR EMERGENCY RELEASE
SPRING-LOADED VALVE RETURNS TO NEUTRAL AS SHOWN WHEN FLAPS REACH SELECTED POSITION
LANDING GEAR CONTROL HANDLE
WING FLAP ACTUATING CYLINDER
LANDING GEAR AND FAIRING DOOR CONTROL VALVE
FAIRING DOOR ACTUATING CYLINDER
LANDING GEAR ACTUATING CYLINDER
LANDING GEAR INDICATING LIGHT
Hydraulic SYSTEM
SYSTEM PRESSURE
UP OR CLOSE
DOWN OR OPEN
SYSTEM RETURN
CHECK VALVE
MECHANICAL LINKAGE
ELECTRICAL CONNECTION
126-00-1554

Figure 1-14

the wing flaps or landing gear. Returning the landing gear handle to NEUTRAL or releasing the wing flap handle puts out the light by relieving the hydraulic pressure.

CAUTION

Do not allow the amber indicating light to remain on for more than 3 minutes, as damage to the hydraulic system could occur.

FLIGHT CONTROL SYSTEM.

The ailerons, elevators, and rudder are conventionally operated through dual cables by a control stick and rudder pedals. Trim tabs on each of the primary surfaces are operable from the cockpit by a cable system.

FLIGHT CONTROLS.

CONTROL STICK.

The control stick has a conventional-type grip, which incorporates a gun and-camera trigger switch. A bomb-rocket release button is located on the top of the stick grip.

CONTROL SURFACE LOCK.

A control surface lock (2, figure 1-7) is located at the base of the front control pedestal. The lock consists of a spring-loaded bracket and locking plunger. The lock bracket is held in a downward position by a spring to prevent inadvertent locking. When the plunger is pulled out of a positioning clip and the bracket is raised, the control stick may be locked. holding the elevators in a full down position and the ailerons neutral. The rudder is not locked until the rudder pedals are moved to a neutral position. The unit is unlocked when the plunger is pulled outboard, the stick is pulled aft, and the plunger and bracket are released.

RUDDER PEDAL ADJUSTMENT LEVER.

A lever (5, figure 1-7), located on the outboard side of each pedal, permits adjusting the position of the rudder pedals. When the lever is moved in an outward direction, the pedals may be adjusted to any desired length. A spring-loaded pin, which engages in holes on the pedal linkage, automatically drops into place when the lever is released. Both pedals must be adjusted equally.

TRIM TAB CONTROLS.

ELEVATOR TRIM TAB CONTROL WHEEL. The elevator trim tab control wheel (19, figure 1-5) is located on the left side of the cockpit, below and aft of the throttle quadrant. The elevator trim tab control wheel is mounted in a vertical plane and is connected to the elevator trim tabs by dual cables. Rolling the wheel forward in the direction of the NH arrow makes the airplane nose-heavy, and rolling the trim wheel in the direction of the TH arrow causes a tail-heavy condition.

RUDDER TRIM TAB CONTROL KNOB. The rudder trim tab control knob (20, figure 1-5) is located horizontally on the left console and is marked "R" and "L" with indicating arrows. A geared pointer indicates the number of degrees the trim tab is moved. Dual cables connect the control knob with the cable drum and actuating screw. A reverse boost action of the trim tab is obtained by a linkage which causes the rudder trim tab to move slightly in the same direction as the rudder, making it necessary to increase rudder pedal pressure to obtain an increase in yaw.

AILERON TRIM TAB CONTROL KNOB. The aileron trim tab control knob (6, figure 1-5) is mounted vertically on the left side of the cockpit, just aft of the throttle quadrant, and is marked "R" and "L" with indicating arrows. A geared pointer indicates the number of degrees the trim tab on the left aileron is moved.

WING FLAPS.

The wing flaps are hydraulically actuated, and travel is controlled by a handle in the cockpit. The wing flaps have a total downward travel of 45 degrees. The wing flaps should be full up during taxiing because of the minimum ground clearance afforded. There is no emergency means of lowering the flaps if the hydraulic system fails. The flaps must not be lowered fully in flight until airspeed is below 160 mph IAS.

CAUTION

On early airplanes, the landing gear handle must be in NEUTRAL before the wing flaps will operate. Later airplanes permit the flaps to be operated when the landing gear handle is at UP or DOWN.

WING FLAP HANDLE.

The wing flap handle (4, figure 1-5) is located on the left side of the cockpit, just below the upper longeron, and has five positions: 0°, 10°, 20°, 30°, 40°. An additional mark below the 40° position indicates the 45-degree position. For operation, it is necessary to hold the wing flap handle up or down until the flaps and handle reach the desired position. (Follow-up linkage between the flaps and the flap handle positions the

flap handle at the same position as the flaps.) The flap handle must then be released to permit the wing flap selector valve to return to a neutral position, which permits the hydraulic pressure to by-pass (for landing gear operation) and locks the flaps in the position selected.

LANDING GEAR SYSTEM.

The landing gear system on the airplane is a conventional type, with a steering and free-swiveling mechanism provided for the nonretractable tail wheel. Main wheels retract inboard into the belly of the airplane, and fairing doors cover the wheel well and strut openings. After the landing gear is down and locked, the fairing doors close to prevent dirt, etc, from entering the wheel wells. An emergency bungee is incorporated to pull the landing gear to the down-and-locked position in case of hydraulic system failure. It may be necessary to relieve hydraulic pressure by use of the flap handle and to rock the wings before the emergency bungee can pull the landing gear down. If leakage to the landing gear selector valve is broken, an emergency mechanical means is provided to operate the landing gear selector valve and uplocks. Landing gear warning lights indicate positions of the main gear and fairing doors.

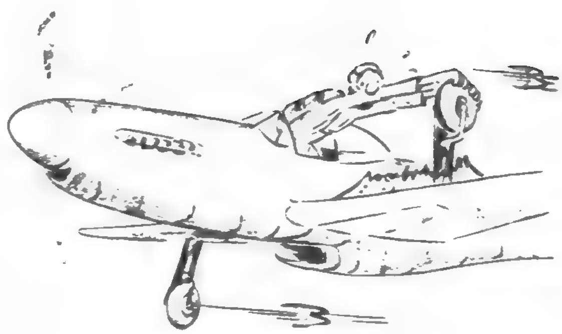
CAUTION

During wing flap operation, there is no hydraulic pressure available to the landing gear until the wing flap handle is released.

LANDING GEAR SYSTEM CONTROLS.

LANDING GEAR HANDLE.

The landing gear handle (17, figure 1-5), located on the left side of the cockpit, near the floor beside the seat, has UP, DOWN, and NEUTRAL positions. Through a mechanical linkage, the handle positions the landing gear selector valve and releases the main gear locks and fairing door locks. The handle is spring-loaded outboard and has notches at each position for the handle. The handle must be moved inboard before it can be moved to either UP or DOWN position. The gear handle is returned to NEUTRAL (to lock the fairing doors) after the hydraulic pressure indicator light has been illuminated for 30 seconds. Waiting for the light indication ensures that the gear has reached the selected position. If the landing gear handle is accidentally moved to UP while the airplane is on the ground, the weight of the airplane prevents the landing gear from retracting. The airplane must be moving to retract the gear on the ground.



Warning

Do not reverse movement of landing gear handle after starting it toward the DOWN position.

WARNING

Reversing the movement interrupts the operating sequence and may result in gear and door interference.

LANDING GEAR EMERGENCY RELEASE HANDLE.

A landing gear emergency release handle (1, figure 1-7) is located on the floor, directly aft of the control pedestal. Although normally the landing gear handle is moved to the DOWN position for emergency operation of the gear, the emergency release handle is used in event the landing gear control handle linkage is broken. The landing gear emergency release handle operates the landing gear selector valve and releases the locks on the landing gear and fairing doors. It replaces the landing gear handle operation in an emergency, but will only lower the gear.

LANDING GEAR SYSTEM INDICATORS.

LANDING GEAR WARNING LIGHTS.

Three green lights and a red light (31, figure 1-4) are provided in the center of the front switch panel to indicate fairing door and landing gear position. All lights are push-to-test type and are equipped with dimmer masks. The green safe light for the tail wheel will

not operate because of the fixed tail wheel. The warning lights operate as follows:

1. With the wheels down and locked, the green lights are on. The red light is off regardless of throttle position.

2. With either or both wheels in any unlocked position but not fully retracted, and regardless of fairing door position, one or more green lights are off and the red gear unsafe warning light is on.

3. With the wheels fully retracted and the throttle forward, all lights are off. If the throttle is retarded, the red light comes on. If the fairing doors are open to any degree when throttle is retarded, the red light comes on.

LANDING GEAR WARNING HORN.

A landing gear warning horn is located aft of the pilot's seat. The horn sounds if the landing gear is in any position other than down and locked and the throttle is retarded below minimum cruising power. A horn cutout button (36, figure 1-4) is provided on the front switch panel. After the cutout button is used, the horn circuit is automatically reset when the throttle is advanced beyond the minimum cruising power position.

TAIL WHEEL STEERING.

The tail wheel is selectively free-swiveling or steerable. When the control stick is moved aft of the neutral position, the tail wheel is direct-steering 6 degrees right and left through a cable system tied to the rudder pedals. Moving the control stick forward of neutral allows the tail wheel to free-swivel.

Note

The tail wheel cannot be locked after full-swiveling unless the rudder is in the neutral position and the control stick is in the normal or aft position.

BRAKE SYSTEM.

The main landing gear spot-type brakes, each wheel having a three-spot unit, are operated in a conventional manner when the rudder pedals are depressed by toe action. The brake hydraulic system is entirely separate from the general hydraulic system, except that the same reservoir supplies fluid to both systems. A standpipe within this reservoir ensures a reserve for the brake system even though the fluid for the main system is lost.

PARKING BRAKE HANDLE.

A parking brake handle (6, figure 1-7) is located below the center of the instrument panel. Pulling this handle out after depressing the brake pedals locks the brakes. The brake pedals must be released while the parking brake handle is held out. Releasing the brakes is accomplished by depressing both brake pedals.

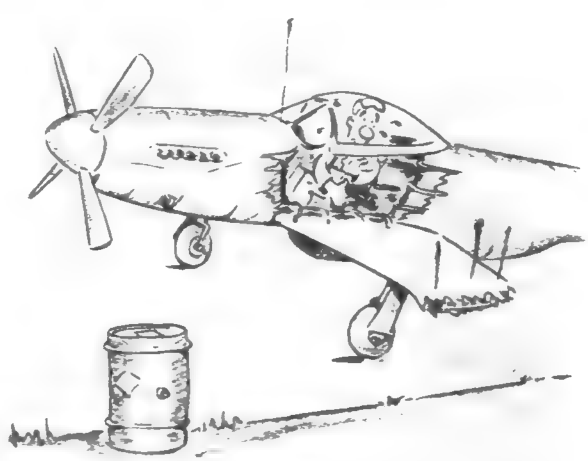
INSTRUMENTS.

The instruments are classified into three groups: flight, engine, and miscellaneous. Suction for the directional gyro, gyro horizon, and turn-and-bank indicator is supplied by an engine-driven vacuum pump. Static pressure for the altimeter, airspeed indicator, and rate-of-climb indicator is taken through a static plate mounted on each side of the fuselage just forward of the stabilizer. Pitot pressure is supplied through a pitot head located beneath the right wing. A remote-indicating magnetic compass and a magnetic stand-by compass are installed. Miscellaneous instruments consist of an ammeter and a clock.

EMERGENCY EQUIPMENT.

SIGNAL PISTOL.

On Airplanes AF44-64160 through -64279, a signal pistol is stowed on the aft side of the cockpit, alongside of the pilot's seat.



Caution

Signal pistol must not be stowed while loaded, as it is cocked when breech is closed.

SIGNAL PISTOL MOUNT.

A signal pistol mount is installed directly above the stowage bracket on the left side of the fuselage. The mount incorporates recoil springs and is fixed to permit the pistol to be fired outboard and aft. Cartridges are stowed in a canvas container strapped to the floor to the right and aft of the pilot's seat.

CANOPY.

The canopy is a one-piece plastic type that slides rearward on tracks to permit entrance to the cockpit. Manual means of opening the canopy are provided inside and outside of the airplane. A means of mechanically declutching the mechanism, to permit the canopy to be pushed open, is provided for the outside of the cockpit. An emergency means for mechanically releasing the canopy from either inside or outside of the airplane is also provided.

CANOPY CONTROLS.

CANOPY HANDCRANK.

A canopy handcrank (3, figure 1-6; figure 1-15), located on the upper right longeron below the windshield bow, is used for normal canopy operation. The handcrank handle has a spring-loaded latch, which, when depressed, allows the handcrank to be turned to operate the canopy. When the latch is released, the canopy is locked in any desired position.

Figure 1-15

CANOPY EXTERNAL DECLUTCHING BUTTON.

A flush button on the right side of the fuselage (figure 2-2), below the windshield bow, allows sliding the canopy aft from outside the airplane. Depressing the button declutches the canopy handcrank so that the canopy can be manually slid aft on its attachment rails. A flush-mounted handle on the right side of the canopy facilitates moving the canopy fore or aft.

CANOPY EMERGENCY RELEASE HANDLE.

A canopy emergency release handle (19, figure 1-4; figure 1-15), located in the cockpit, permits jettisoning the canopy during in-flight emergencies. The handle is located on the upper right longeron, and light-gage safety wire is used to prevent inadvertent actuation. Pulling the handle out and back mechanically releases the latch, which allows the canopy to disengage from its track and to blow clear of the airplane.

Warning

Before emergency release of the canopy in flight, drop seat and lower head as much as possible.

WARNING

If excessive force is used in closing canopy, it may be necessary to crank the canopy back enough to relieve pressure against the windshield bow before the emergency release is effective.

CANOPY EXTERNAL EMERGENCY RELEASE HANDLE.

An external canopy emergency release handle (figure 1-15) is provided on the right side of the fuselage, below the windshield bow. The external emergency release handle is directly linked to the internal handle, and operation of the handle disengages the canopy from its rails. The canopy may then be lifted off the airplane.

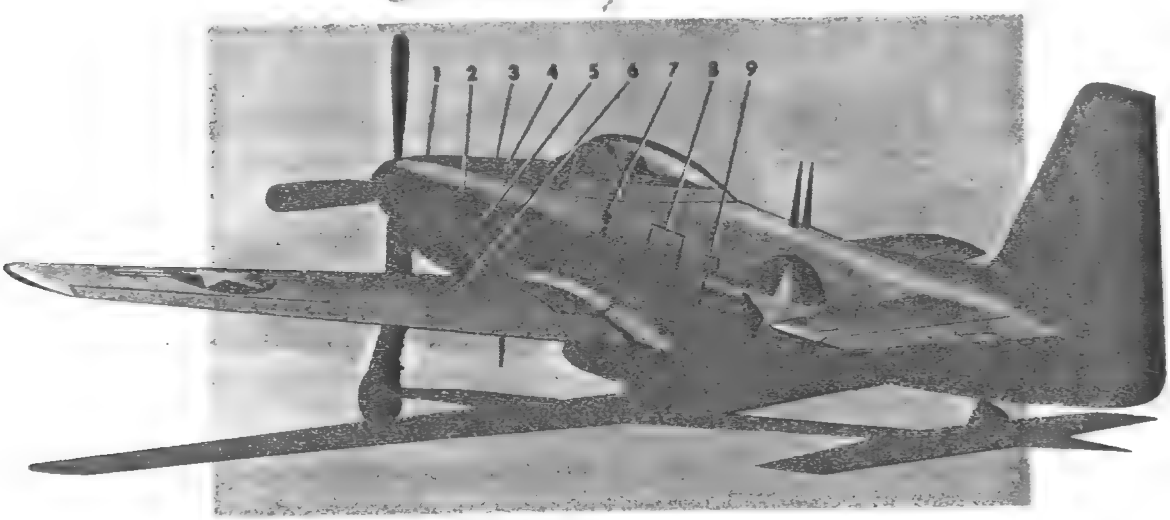
SEAT.

A bucket-type seat for the pilot has an adjustable height mechanism; an inertia reel and a shoulder harness are attached. The seat is designed for use with a seat-type parachute, and a kapok-filled back cushion may be used as a life preserver. The seat height adjusting lever is located at the lower right side of the seat and allows adjustment to any one of 12 height levels. A padded headrest is provided at the top of the seat and is attached to the seat armor plating.

SHOULDER-HARNESS LOCK HANDLE.

A two-position (locked and unlocked) shoulder-harness inertia reel lock handle (18, figure 1-4) is located on the left side of the pilot's seat. A latch is provided for positively retaining the control handle at either position of the quadrant. When the top of the control handle is pressed down, the latch is released and the control handle may then be moved freely from one position to another. When the control is in the unlocked position, the reel harness cable will extend to allow the pilot to lean forward in the cockpit; however, the reel harness cable automatically locks when an impact force of 2 to 3 G is encountered. When the reel is automatically locked in this manner, it remains locked until the control handle is moved to locked and then returned to the unlocked position. Rapidly pulling the shoulder harness by hand will not check the automatic locking feature of the inertia reel. When the control is in the locked

Servicing DIAGRAM



1. COOLANT HEADER TANK
2. HYDRAULIC RESERVOIR (RH SIDE)
3. AFTERCOOLER TANK
4. OIL TANK
5. WATER INJECTION TANK (RH SIDE)
6. LH WING FUEL TANK (RH SIMILAR)
7. FUSELAGE FUEL TANK
8. BATTERY
9. OXYGEN TANK FILLER

SPECIFICATIONS

FUEL—	MIL-F-5572, GRADE 100/130
OIL—	MIL-L-6082, GRADE 1100/1120
HYDRAULIC FLUID—	MIL-O-5606
COOLANT—	MIL-E-5559, TYPE C OR D

128-00-1543

Figure 1-16

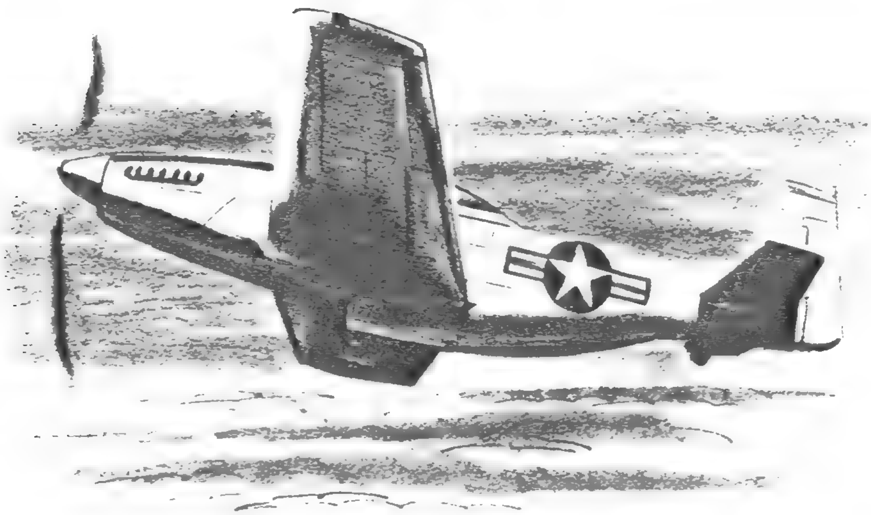
position, the reel harness cable is manually locked so that the pilot is prevented from bending forward. If the harness is locked while the pilot is leaning forward, the harness will retract with him as he straightens up, moving in successive locked positions as he moves back against the seat. To unlock the harness, the pilot must be able to lean back enough to relieve the tension on the lock. Therefore, if the harness is locked while the pilot is leaning back hard against the seat, he may not be able to unlock the harness without first releasing it momentarily at the safety belt (or releasing the harness buckles, if desired). The locked position is used only during aerobatics and flight in rough air, or as an added precaution when a crash landing is anticipated.

CAUTION

All switches not readily accessible with the harness locked should be properly positioned before the harness lock handle is moved forward to the locked position.

AUXILIARY EQUIPMENT.

Information pertaining to the description and operation of the following auxiliary equipment is included in Section IV: heating and ventilating, defrosting, communication, lighting, oxygen, anti-G suit, and armament (guns, bombs, rockets, and sight).



Normal Procedures

STATUS OF THE AIRPLANE.

FLIGHT RESTRICTIONS.

Detailed airplane and engine limitations are listed in Section V.

FLIGHT PLANNING.

From the operating data contained in Appendix I, determine fuel consumption, correct airspeed, and power settings necessary to accomplish the intended mission. The Appendix data will enable you to properly plan your flight so that you can obtain the best possible performance from your airplane.

WEIGHT AND BALANCE.

Refer to Section V for weight and balance restrictions. Refer to Handbook of Weight and Balance Data T. O. No. 1-1B-40 for loading information. Before each mission, make the following checks:

1. Check take-off and anticipated landing gross weight and balance.

2. Check that fuel, oil, armament, and special equipment carried are sufficient for the mission to be accomplished.

3. Check that weight and balance clearance (Form F) is satisfactory.

ENTRANCE.

A step attached to the landing gear oleo strut permits mounting onto the wing. (See figure 2-1.)

Caution

The leading edge of the wing should not be used as a step because of the possibility of damage to this area.

CAUTION

However, the section approximately 12 inches aft of the leading edge is sufficiently reinforced.

Entering Airplane

Enter airplane on right side.

CAUTION:
Avoid stepping on unsupported areas of wing.

Push in on release button below windshield frame and slide canopy aft.

NOTE:
After canopy is open sufficiently to reach inside cockpit, use handcrank to run canopy fully open.

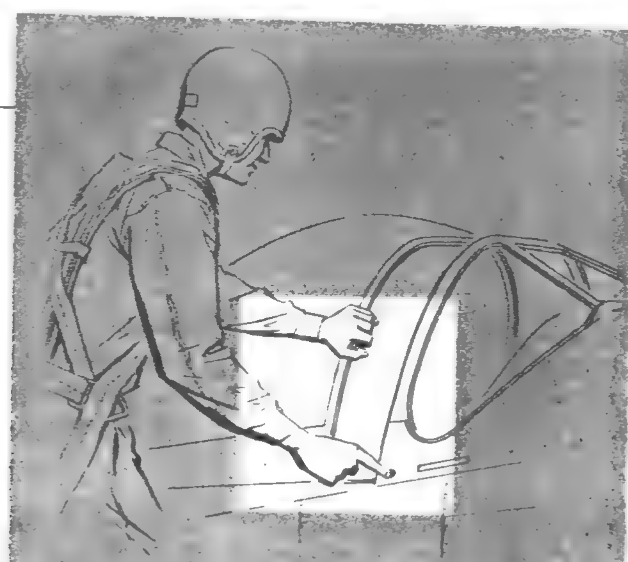


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Figure 2-1

When the canopy declutching button, located on the right side of the airplane, below the windshield frame, is depressed, the canopy can be opened enough to enable use of the canopy handcrank inside the cockpit. A means for mounting onto the wing from the left side is also provided. However, the canopy cannot be opened from this side.

BEFORE EXTERIOR INSPECTION.

Check Form 1 for engineering status, and make sure airplane has been properly serviced. If at a strange field, check cooling system before flight. Before removing coolant cap, let cool for at least one hour. See figure 1-12 for complete servicing data. Prior to the exterior inspection, make the following safety checks:

1. Landing gear handle NEUTRAL.
2. Battery-disconnect switch OFF.
3. Ignition switch OFF.
4. Gun safety switch OFF.
5. Bomb arming switches OFF.
6. Rocket release switch OFF.
7. Bomb-rocket selector switch OFF.

EXTERIOR INSPECTION.

Exterior inspection should be accomplished as shown in figure 2-2.

ON ENTERING COCKPIT.

INTERIOR CHECK (ALL FLIGHTS).

Note

This procedure is arranged in a clockwise direction around the cockpit in order to minimize the necessary motions and still check each item thoroughly.

1. Fasten safety belt and shoulder harness. Check operation of shoulder-harness lock; leave UNLOCKED.
2. Adjust seat level to obtain full travel of rudder pedals in extreme position.
3. Adjust rudder pedals for proper leg length to obtain full brake control. Press foot against lever on outer side of each pedal.
4. Unlock control lock at base and just forward of control stick by pulling plunger on right side of lock.
5. Check controls for free and proper movement, watching control surfaces for correct response.
6. Wing flap handle full up.
7. Landing light switch OFF.
8. Gun sight gyro motor switch ON (K-14A sight only).

CAUTION

To prevent damage to gyro, make sure gun sight is operating before starting engine and keep sight on at all times when engine is running.

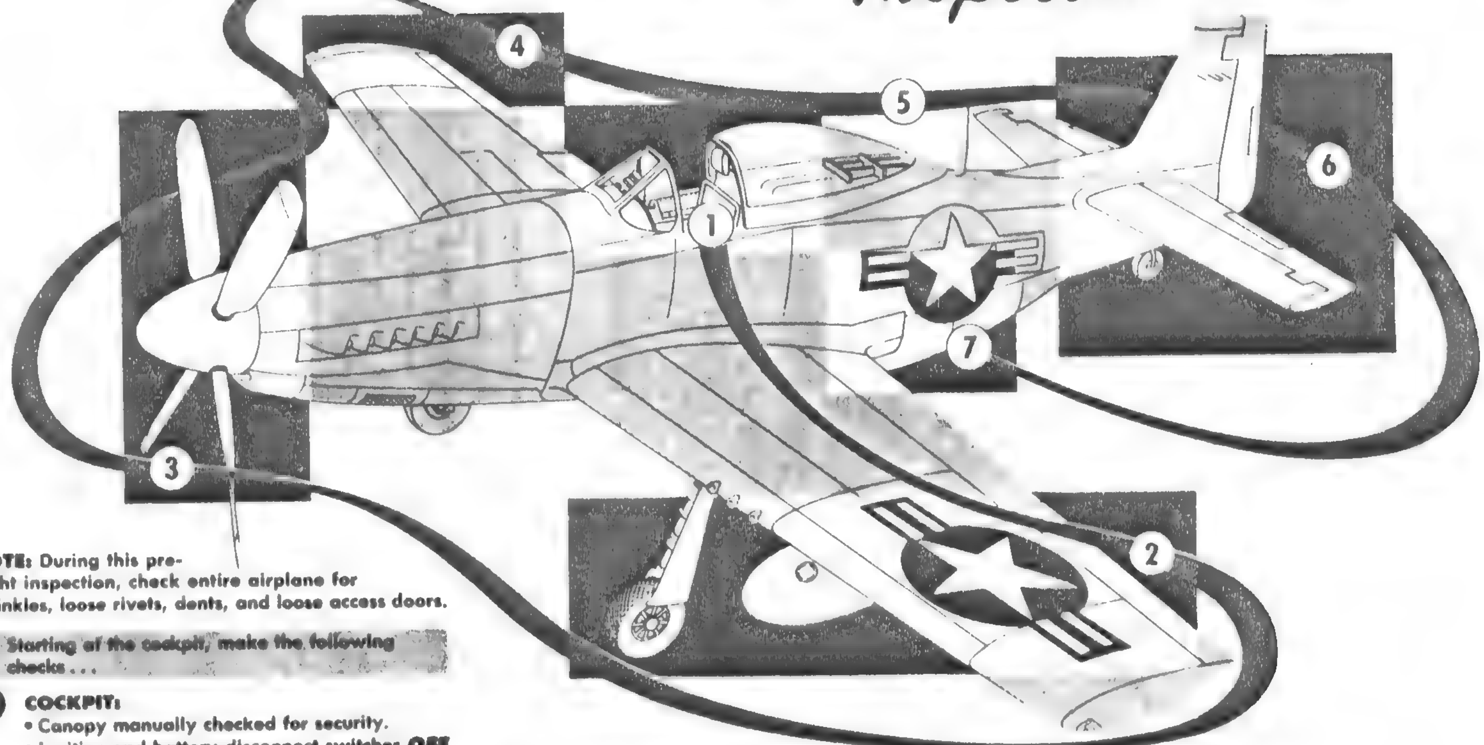
9. Throttle one inch open (in START position).
10. Friction lock on throttle quadrant adjusted for friction.
11. Propeller control full INCREASE.
12. Water injection switch OFF.
13. Gyro instruments uncaged.
14. Altimeter set to field elevation.
15. Ignition switch OFF.
16. Check generator-disconnect switch ON.
17. Circuit-breaker reset button pushed.
18. Mixture control at IDLE CUTOFF.
19. Parking brakes set.
20. Air temperature modulator lever at VENTILATION WHEN HEATER OFF.
21. Air distribution selector at AIR OFF TURN HEATER OFF.
22. Fuel tank selector handle to MAIN WING TANKS.
23. Check landing gear warning lights. (Battery-disconnect switch ON temporarily.)
24. Note manifold pressure reading (field barometric pressure) for subsequent use during preflight engine check.
25. Clock set.
26. Supercharger control switch AUTO.
27. Cockpit heater switch OFF.
28. Pitot heater switch OFF.
29. Gun heater switch OFF.
30. Check canopy emergency release handle for safetying.
31. Radio and communication equipment switches OFF.
32. Carburetor air control lever at FILTERED AIR for all ground operation.
33. Coolant flap emergency release handle for safetying.
34. Oxygen gage pressure 400 psi. Test oxygen equipment for operation.

INTERIOR CHECK (NIGHT FLIGHTS).

In addition to the preceding check, perform the following checks for night operation:

1. Turn on and check all cockpit lights.

EXTERIOR *Inspection...*



NOTE: During this preflight inspection, check entire airplane for wrinkles, loose rivets, dents, and loose access doors.

Starting at the cockpit, make the following checks . . .

1 COCKPIT:
- Canopy manually checked for security.
- Ignition and battery-disconnect switches **OFF.**
- Check Form 1 for status of airplane and servicing.
- Trim tabs neutral.
- Compare flap handle position with wing flap position.

2 LEFT WING SECTION:
- Condition of wing flaps, trailing edge, and control surface.
- Wing tip and position light.
- Leading edge and gun bay doors secure.
- Wheel well for leaks, gear assembly, downlocks, and strut inflation 2 inches.
- Tire for inflation, wear, and slippage on wheel
- Drop tank fuel level, cap secure.
- Fuel tank level, cap secure.
- Landing light.
- Wheels chocked.

3 ENGINE SECTION:
- Cowl for security.
- Exhaust stack plugs removed.
- Air scoops for obstructions.
- Propeller for nicks and excessive oil.

4 RIGHT WING SECTION:
- Tire for inflation, wear, and slippage on wheel.
- Wheel well for leaks, gear assembly, downlocks, and strut inflation 2 inches.
- Leading edge and gun bay doors secure.
- Fuel tank level, cap secure.
- Drop tank fuel level, cap secure.
- Pitot cover removed, check for obstructions.
- Wing tip and position light.
- Condition of control surface, trailing edge, and wing flaps.

5 RIGHT FUSELAGE SECTION:
- Coolant flap for condition and position.
- Static pressure vent clean.
- Radio antenna for security.

6 TAIL SECTION:
- Surfaces and controls for condition.
- Position light.
- Trim tab position.
- Tail wheel tire for damage, slippage, and inflation of strut.

7 LEFT FUSELAGE SECTION:
- Static pressure vent clean.
- Fuel cap secure.

136-00-1546

Figure 2-2

2. Turn on position lights.
3. Make sure personal gear includes a flashlight.
4. All switches OFF after checks are completed.

STARTING ENGINE.

The following procedure should be used to start the engine. Starting should be accomplished with the airplane on a paved surface and headed into the wind whenever possible. Have the fire guard stand at the right wing tip for safety.

1. Ignition switch and battery-disconnect switch OFF.
2. Mixture control IDLE CUTOFF.
3. Have ground crew pull propeller through several revolutions.
4. External power supply connected. (Battery-disconnect switch ON if external power supply is not available.)

Note

Use of battery power is considered an emergency measure.

5. Check throttle open approximately one inch (1500 rpm). (To START position on late airplanes.)

CAUTION

To prevent runaway engine, the throttle should not be advanced beyond one inch for starting. If the throttle is beyond this point, the butterfly position in the carburetor must be visually checked before the engine is started.

6. Coolant flap control switch at OPEN until flap is fully opened; then release switch to OFF.

CAUTION

For all ground operation, the coolant flap should be fully opened to prevent overheating.

7. Check that propeller is clear.
8. Hold starter switch at ON.
9. Ignition switch to BOTH after six blades have passed.

CAUTION

Keep hand on ignition switch ready for emergency shutoff in case of runaway engine. (In case of runaway engine, airplane must be tied down for next run-up.)

10. Fuel booster pump switch to ON.
11. Primer switch ON 2 seconds when cold, one second when warm.
12. When engine starts, move mixture control to RUN and release primer switch as engine smooths out. Do not jockey throttle. If engine does not start after turning several revolutions, continue priming.

WARNING

The mixture control should always be in IDLE CUTOFF when the engine is not firing, to prevent excess fuel entering the induction system and causing a fire hazard.

13. Check oil pressure. If it is not at 50 psi within 30 seconds after engine starts, stop engine and investigate.
14. Move battery-disconnect switch to ON after disconnecting external power source.

ENGINE GROUND OPERATION.

After engine starts, place supercharger control switch at HIGH; then warm up engine at 1300 rpm until oil temperature shows a definite increase and oil pressure remains steady when additional throttle is applied. The following checks should then be made:

WARNING

Do not exceed 2200 rpm in high blower on the ground, as this will tend to cause detonation.

1. Fuel system check—rotate fuel tank selector handle and check fuel pressure for proper operating range of each tank. Fuel booster pump switch must be ON. If drop tanks are installed, check fuel flow from each. Position fuel tank selector handle at MAIN WING TANKS for take-off.
2. Radiator air outlet flap—move coolant flap control switch to OPEN and CLOSE positions and have outside observer verify its operation. Hold switch at OPEN until radiator air outlet flap is fully open; then release switch to OFF.
3. Check oil, coolant, and fuel gages for proper indications. Place supercharger control switch at AUTO.
4. Ignition system check—at 700 rpm, turn ignition switch OFF momentarily. If engine does not cease firing completely, shut down engine and warn all personnel to keep clear of propeller.

CAUTION

Perform this check as rapidly as possible, to prevent severe backfire when ignition switch is returned to BOTH.

5. Propeller check — with propeller control in full INCREASE, set throttle to obtain 2300 rpm. Move propeller back to DECREASE position to note maximum drop of 300 rpm. Return control to INCREASE.

6. Manifold pressure regulator check — watch manifold pressure during propeller check. Manifold pressure should remain constant within one in. Hg.

7. Supercharger check — at 2300 rpm, place supercharger control switch at HIGH; there should be at least a 50 rpm drop. Return supercharger control switch to AUTO.

8. Deleading spark plugs — should prolonged ground operation be necessary, such as for checking engine condition or performing numerous preflight checks, run engine at 61 in. Hg manifold pressure and 3000 rpm for one continuous minute prior to take-off.

CAUTION

Do not exceed 40 in. Hg during ground run-up without having tail tied down, because of the possibility of airplane nosing over. The stick must be held full back on all run-ups.

GROUND TESTS.

Check operation of wing flaps. Turn on necessary communication equipment and ascertain that signals are audible and clear. Check instruments in proper ranges.

TAXIING.

Use the following procedure during taxiing:

1. Remove chocks and release parking brake. Let airplane roll forward slightly, and check brakes.

CAUTION

Never allow taxi speed to build up before checking brakes.

2. Steer a zigzag course to obtain an unobstructed view.

3. Taxi with stick slightly aft of neutral to prevent excessive loads on tail wheel and to lock tail wheel. In the locked position, the tail wheel may be turned 6 degrees right or left with the rudder pedals. For sharp turns, push stick slightly forward of neutral position to allow full-swiveling action of tail wheel.

4. Use brakes as little as possible, to prevent overheating.

CAUTION

In order to avoid excessive use of brakes, taxi at idle rpm.

5. Upon reaching take-off position, stop airplane at right angles to runway so that approaching airplanes may be seen.

CAUTION

Taxi cautiously to avoid damage from objects which tires or propeller might pick up and throw against radiator air outlet flaps.

BEFORE TAKE-OFF.

PREFLIGHT AIRPLANE CHECK.

Before take-off, check safety belt fastened and shoulder harness unlocked; then check:

1. Primary Controls:
   Check surface controls for free movement.
2. Instruments and Switches:
   Altimeter set.
   Directional gyro set.
   Gyro horizon set.
   All instrument readings in desired ranges.
   All switches and controls at desired positions.
3. Fuel System:
   Check fuel tank selector handle on MAIN WING TANKS. Be sure selector is in detent. (Refer to Section VII for instructions concerning fuel sequence during flight.)
   Fuel booster pump switch at ON.
   Primer switch OFF.
4. Flaps:
   Flaps set for take-off (UP for normal take-off).
5. Trim:
   Trim tabs set for take-off (rudder 7 degrees R; elevator 2 degrees NH; aileron 0 degrees).
6. Check all circuit breakers in.
7. Check that cockpit enclosure is locked and that canopy emergency release handle is safetied.

PREFLIGHT ENGINE CHECK.

Note

Tap instrument panel while performing checks requiring rpm readings, to prevent tachometer sticking.

1. Check propeller at full INCREASE.

2. Power check—advance throttle to obtain 2300 rpm. At this rpm, the manifold pressure should read ½ in. Hg less than field barometric pressure within ±½ in. Hg.

Note

Manifold pressure in excess of field barometric pressure indicates that the engine is not producing maximum power and should be checked.

3. Ignition system check—at 2300 rpm, with propeller in full INCREASE, move ignition switch from BOTH to L, back to BOTH, then to R, and back to BOTH. Let engine speed stabilize at BOTH between checks. A maximum drop of 100 rpm is allowable for the right magneto and 120 rpm drop for the left magneto. If rpm drop is more than allowable, spark plugs will have to be deleaded. (Refer to Engine Ground Operation in this section.)

4. Idle speed check—idle engine at 650 to 700 rpm with throttle against idle stop.

5. Acceleration and deceleration check—with mixture control at RUN, advance throttle from idle to 2300 rpm. Engine should accelerate and decelerate smoothly, with no tendency to backfire.

6. Set throttle for 1500 rpm for best cooling during prolonged ground operation.

7. Carburetor air control lever at COLD AIR RAMMED position. (FILTERED AIR or HOT AIR UNRAMMED only if required.)

CAUTION

Anticipate longer take-off run if HOT AIR UNRAMMED is used.

8. Check mixture control at RUN.

9. Check supercharger control switch at AUTO.

10. Coolant flaps control switch at AUTOMATIC.

CAUTION

- If coolant temperature exceeds 100°C, place coolant flap control switch in OPEN position until air-borne.
- If coolant temperature exceeds limits and/or the coolant relief valve pops off, the engine must be immediately shut down and inspected for coolant leaks.

11. If it is necessary to wait long before take-off, recheck magnetos to see if any spark plug leading is present.

TAKE-OFF.

Plan your take-off according to the following variables affecting take-off technique: gross weight, wind, outside air temperature, type of runway, and height and distance of the nearest obstacles. See figure A-5 for required take-off distances.

NORMAL TAKE-OFF.

In order to perform a take-off within the distance specified in the Take-off Distances charts (figure A-5), the following procedure must be used:

1. Be sure take-off area is clear and check final approach for aircraft.

2. Release brakes and line up for take-off.

3. Advance throttle smoothly and steadily to Take-off Power.

Note

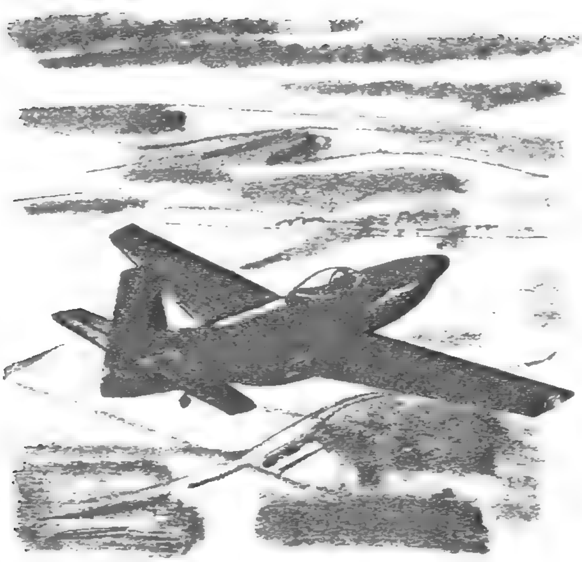
It is recommended that 61 in. Hg and 3000 rpm be used for all take-offs and that this power setting be reached as quickly as possible after the take-off run is started. Do not jam throttle forward, as torque will cause loss of control of airplane.

4. If rough engine occurs during take-off run, immediately throttle back 4 or 5 in. Hg manifold pressure to complete take-off if conditions permit. Throttling back tends to decrease the intensity of detonation or preignition and minimizes the chances of engine failure. If this condition occurs on take-off, the spark plugs must be changed before the next flight.

5. Do not attempt to lift tail too soon, as this increases torque action. Pushing the stick forward unlocks the tail wheel, thereby making steering difficult. The best take-off procedure is to hold the tail down until sufficient speed for rudder control is attained and then to raise the tail slowly.

MINIMUM-RUN TAKE-OFF.

To accomplish a minimum-run take-off (figure 2-3), lower flaps 15 to 20 degrees. Keep airplane in a three-point attitude and allow it to fly itself off ground in this position. As soon as air-borne, allow airspeed to build up and climb out at 100 mph. Retract landing gear when airspeed reaches a safe value. Raise flaps above 200 feet altitude.



CROSS-WIND TAKE-OFF.

The following procedure is recommended for a cross-wind take off:

1. Advance throttle to Take-off Power.

2. Hold tail down until sufficient speed is attained to ensure positive rudder control. Speed should be slightly greater than for normal take-off.

3. Apply sufficient aileron control to keep wings level or even to effect a slightly wing-low attitude into wind.

4. Keep airplane firmly on runway until speed is sufficient to make a smooth, clean break.

5. After becoming air-borne, crab into wind enough to counteract drift.

NIGHT TAKE-OFF.

Night take-off procedure is the same as that for daylight operation. However, a thorough knowledge of switch and light location is essential. The following additional checks are recommended for night take-off:

1. Turn cockpit lights low.

2. Tune radio carefully and loud, as it will fade during take-off and flight.

3. Hold airplane steady on a reference point during take-off run.

AFTER TAKE-OFF.

1. As soon as airplane is definitely air-borne, retract landing gear by pulling landing gear handle inboard and up. Check position of gear by warning lights and hydraulic pressure system indicator light.

WARNING

Do not move landing gear control handle to NEUTRAL position until after red landing gear warning light goes off and hydraulic pressure amber indicator light illuminates and remains on steadily for 30 seconds. Surges in the hydraulic system may sometimes cause momentary illumination of the amber indicator light during gear retraction or lowering, and must not be construed as an indication of gear cycle completion.

2. On minimum-run take-off, when sufficient airspeed is attained and all obstacles are cleared, raise flaps to full up position. Very little sink is noticeable when flaps are raised.

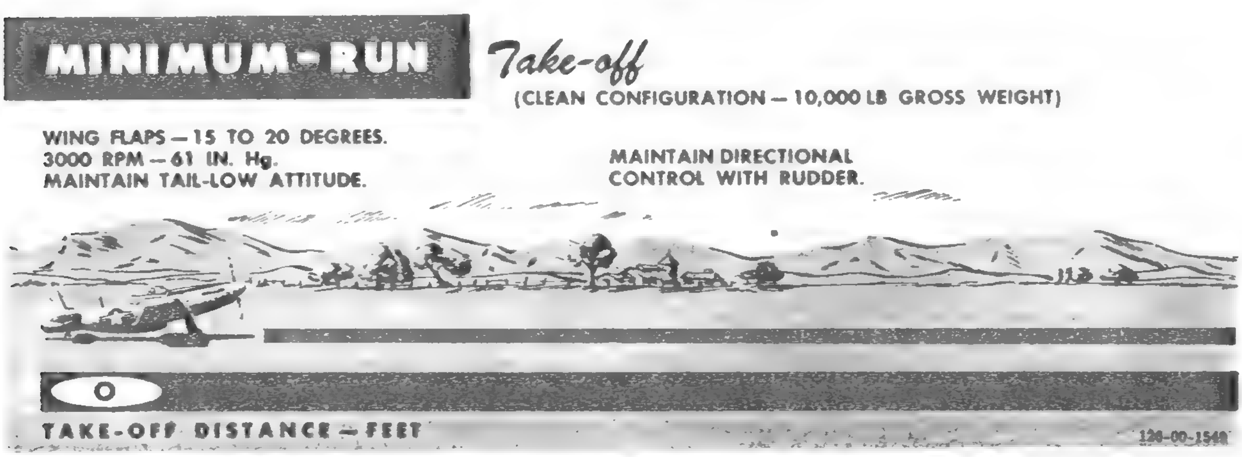


Figure 2-3 (Sheet 1 of 2)

3. Check coolant and oil temperatures and oil pressure.

WARNING

Do not apply brakes after take-off to stop rotation of wheels, as brake disks may seize.

CLIMB.

1. Allow airspeed to build up to 170 mph for normal climb.

2. Check coolant and oil temperatures and oil pressure during flight.

3. Refer to climb charts (figures A-6 and A-7) for power settings, recommended airspeed, rate of climb, and fuel consumption.

FLIGHT CHARACTERISTICS.

Refer to Section VI for all data on flight characteristics.

SYSTEMS OPERATION.

Refer to Section VII for information on systems operation.

DESCENT.

Before descent, turn air distribution selector to AIR TO WINDSHIELD ONLY. Descent may be carried out at any safe speed down to the recommended margin of about 25 percent above stalling speed. With the landing gear and flaps up, the glide is fairly flat with the nose very high. Forward visibility is poor in this condition, and in traffic areas, a series of mild "S" turns should be employed to prevent possible collision. Lowering either the flaps or landing gear, or both, greatly increases the gliding angle and the rate of descent.

PRE-TRAFFIC-PATTERN CHECK.

Before entering the traffic pattern, accomplish the following:

1. Fuel tank selector handle on fullest internal tank.
2. Check that fuel booster pump switch is ON.
3. Check carburetor air control lever as needed.
4. Mixture control at RUN.
5. Propeller set at 2700 rpm.
6. Coolant flap control switch AUTOMATIC.
7. Clean out engine at 3000 rpm and 61 in. Hg for one minute.

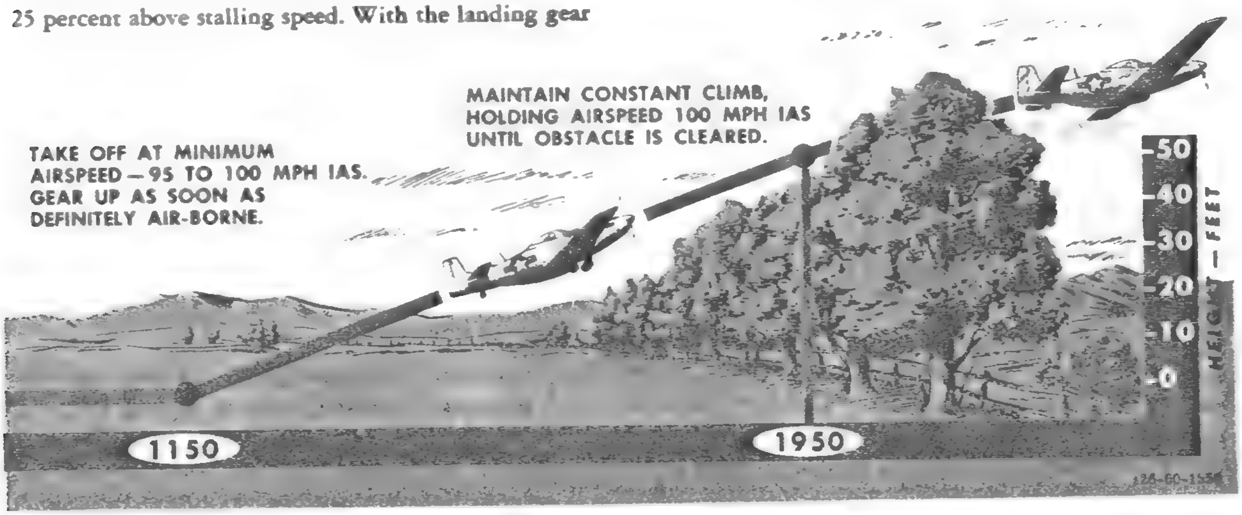
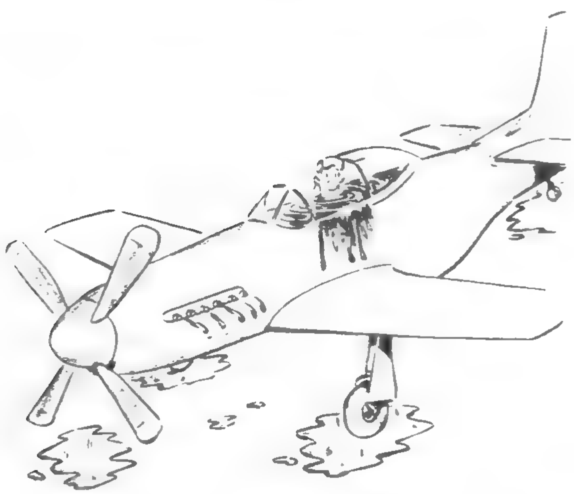


Figure 2-3 (Sheet 2 of 2)

TRAFFIC-PATTERN CHECK.

Traffic-pattern procedure and check are shown in figure 2-4. Check position of gear by landing gear indicating lights on front switch panel. Hydraulic pressure system amber indicating light must remain on steadily for 30 seconds before landing gear control handle is returned to NEUTRAL.



Caution

Do not allow amber indicating light to remain on for more than 3 minutes.

CAUTION

The light indicates when the hydraulic system is operating over 1500 psi. Operation at this pressure for more than 3 minutes may seriously damage the hydraulic system.

LANDING.

NORMAL LANDING.

In order to obtain the results stated in the Landing Distances chart (figure A-8), accomplish the approach and landing procedure outlined in figure 2-4. For a normal landing, plan your approach so that you are over the edge of the field at 120 mph. Use a continuous back pressure on the stick to obtain a tail-low attitude for actual touchdown. Because of the wide landing gear and locked tail wheel, landing roll characteristics are excellent on this airplane. Minimize use of brakes during ground roll. At completion of landing roll, clear runway as soon as possible. Refer to Section III for information regarding emergency landings.

CAUTION

When fuselage tank is nearly empty, use caution in landing, because of a slight nose-heavy condition of the airplane.

CROSS-WIND LANDING.

In accomplishing a cross-wind landing, maintain an airspeed slightly higher than for a normal approach. Either use the slip method by lowering the upwind wing or crab into the wind to align flight path with runway. Align airplane with runway at touchdown and maintain direction control with rudder. Minimize use of brakes during landing roll. As soon as practical, clear the runway and stop.

HEAVY-WEIGHT LANDING.

If a heavy-weight landing is to be attempted, maintain an airspeed approximately 20 mph over normal approach speed. Power should be used if a flat approach is made. Flare out smoothly and reduce power until touchdown is effected, and then cut off power completely. Do not use a full stall landing. Complete landing roll as in normal landing.

MINIMUM-RUN LANDING.

Minimum-run landings may be accomplished in either of two ways. If no obstacle is present, lower flaps fully and make a flat power-on approach. Hold airspeed to lowest possible safe limit. When in position, close throttle completely. For a minimum-run landing over an obstacle, lower flaps fully and close throttle completely when sure of clearing obstacle.

NIGHT LANDING.

The same techniques and procedures used for day landings should be used. If landing in thick haze or fog, avoid use of landing light, as reflection from the light impedes vision and may distort depth perception. Use the landing light only as necessary while on the ground. After stopping, clear runway as soon as possible.

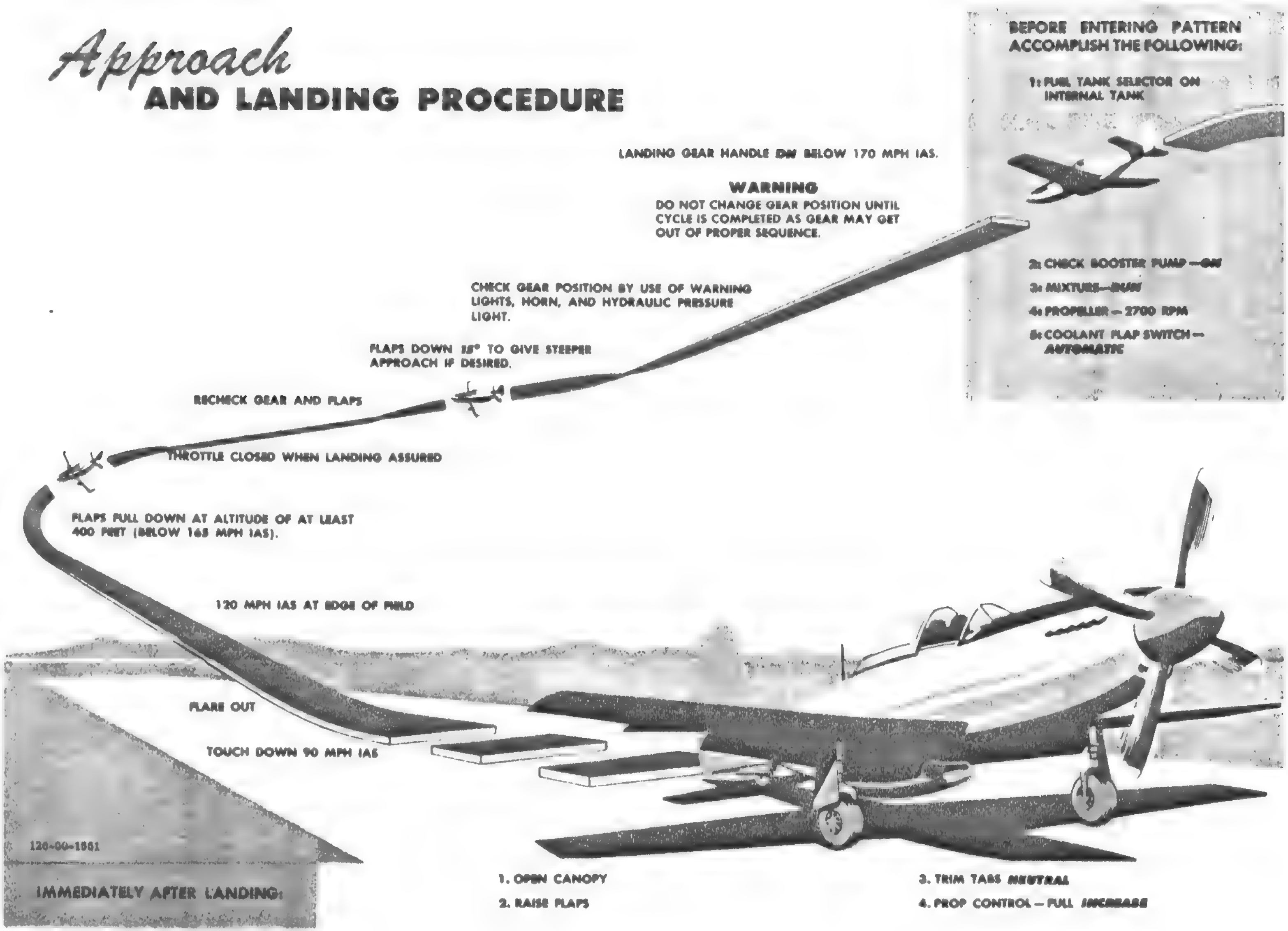

Approach
AND LANDING PROCEDURE
BEFORE ENTERING PATTERN ACCOMPLISH THE FOLLOWING:
1: FUEL TANK SELECTOR ON INTERNAL TANK
2: CHECK BOOSTER PUMP—ON
3: MIXTURE—RUN
4: PROPELLER—2700 RPM
5: COOLANT FLAP SWITCH—AUTOMATIC
LANDING GEAR HANDLE DN BELOW 170 MPH IAS.
WARNING
DO NOT CHANGE GEAR POSITION UNTIL CYCLE IS COMPLETED AS GEAR MAY GET OUT OF PROPER SEQUENCE.
CHECK GEAR POSITION BY USE OF WARNING LIGHTS, HORN, AND HYDRAULIC PRESSURE LIGHT.
FLAPS DOWN 25° TO GIVE STEEPER APPROACH IF DESIRED.
RECHECK GEAR AND FLAPS
THROTTLE CLOSED WHEN LANDING ASSURED
FLAPS FULL DOWN AT ALTITUDE OF AT LEAST 400 FEET (BELOW 165 MPH IAS).
120 MPH IAS AT EDGE OF FIELD
FLARE OUT
TOUCH DOWN 90 MPH IAS
120-00-1881
IMMEDIATELY AFTER LANDING:
1. OPEN CANOPY
2. RAISE FLAPS
3. TRIM TABS NEUTRAL
4. PROP CONTROL—FULL INCREASE

Figure 2-4

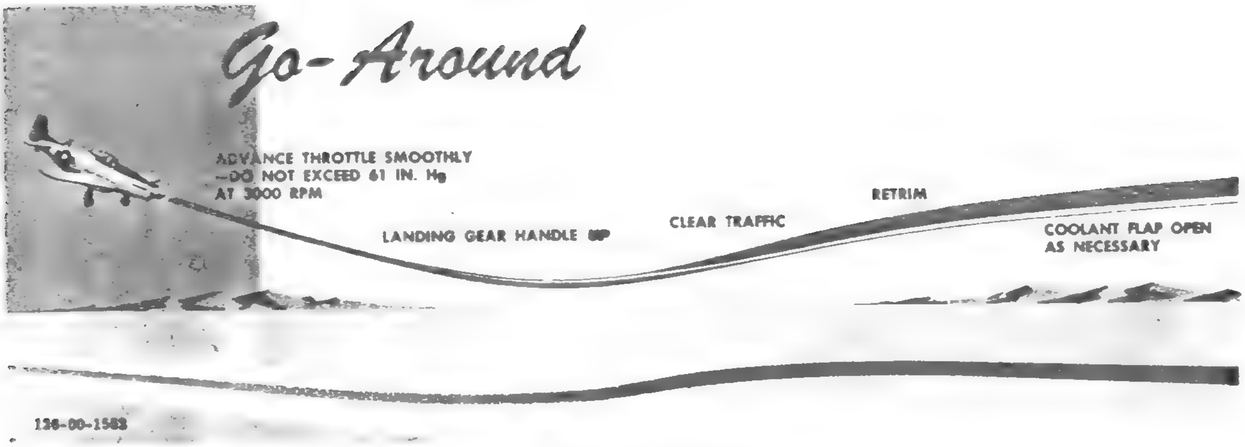


Figure 2-5 (Sheet 1 of 2)

GO-AROUND.

If a go-around is necessary (figure 2-5), use the following procedure:

1. Open throttle smoothly; do not exceed 61 in. Hg at 3000 rpm.
2. Maintain wings level and nose straight.
3. Landing gear handle UP.
4. Raise flaps slowly when at least 200 feet above ground.

AFTER LANDING.

After landing, clear the runway as soon as possible and perform the following:

1. Set throttle at 1000 rpm.
2. Open canopy.
3. Coolant flap control switch at OPEN. Release to OFF when fully open.
4. Raise wing flaps completely.
5. Set trim tabs at neutral.
6. Set propeller control at full INCREASE.

POSTFLIGHT ENGINE CHECK.

After the last flight of the day, make the following checks:

Note

While performing checks requiring rpm reading, it may be necessary to tap the instrument panel to prevent tachometer sticking, especially in cold weather.

1. Check propeller control at full INCREASE.
2. Ignition switch check—at 700 rpm, turn ignition switch OFF momentarily. If engine does not cease firing completely, shut down engine and warn personnel to keep clear of propeller until discrepancy is corrected.

CAUTION

Perform this check as rapidly as possible, to prevent severe backfire when ignition switch is returned to BOTH.

3. Idle speed and mixture check—with throttle against idle stop, the engine should idle at 650 to 700 rpm. When engine idle speed is stabilized, slowly move mixture control toward IDLE CUTOFF and note any change in rpm. The rpm should flick up very slightly, then decrease. A large noticeable rise in rpm indicates that the mixture is too rich. Absence of the slight flick up but a decrease of rpm indicates too lean a mixture. Excessively rich or lean mixtures increase cylinder head temperature and promote spark plug fouling. Return mixture control to RUN before engine cuts out.
4. Power check—advance throttle until rpm is 2300. At this rpm, the manifold pressure should read ½ in. Hg less than field barometric pressure within ±½ in. Hg.

Note

Manifold pressure in excess of field barometric pressure indicates that engine is not producing maximum power and should be checked.

STOPPING ENGINE.

When a cold-weather start is anticipated, dilute oil as required by the lowest expected temperature. For oil dilution instructions, refer to Section IX.

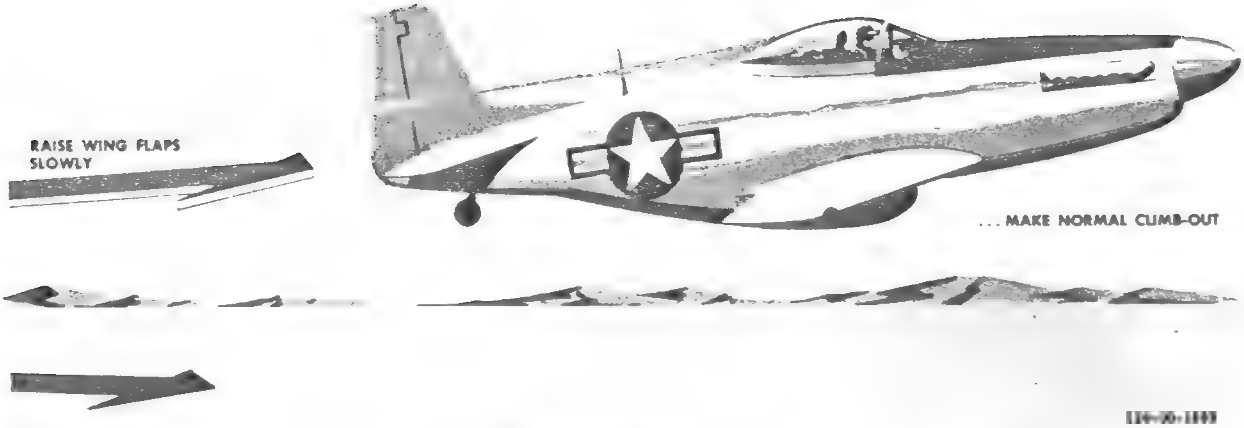


Figure 2-5 (Sheet 2 of 2)

1. Parking brakes set.
2. Fuel booster pump switch OFF.
3. Advance throttle to 1500 rpm and run until temperatures stabilize to prevent hot spots.
4. Mixture control to IDLE CUTOFF.

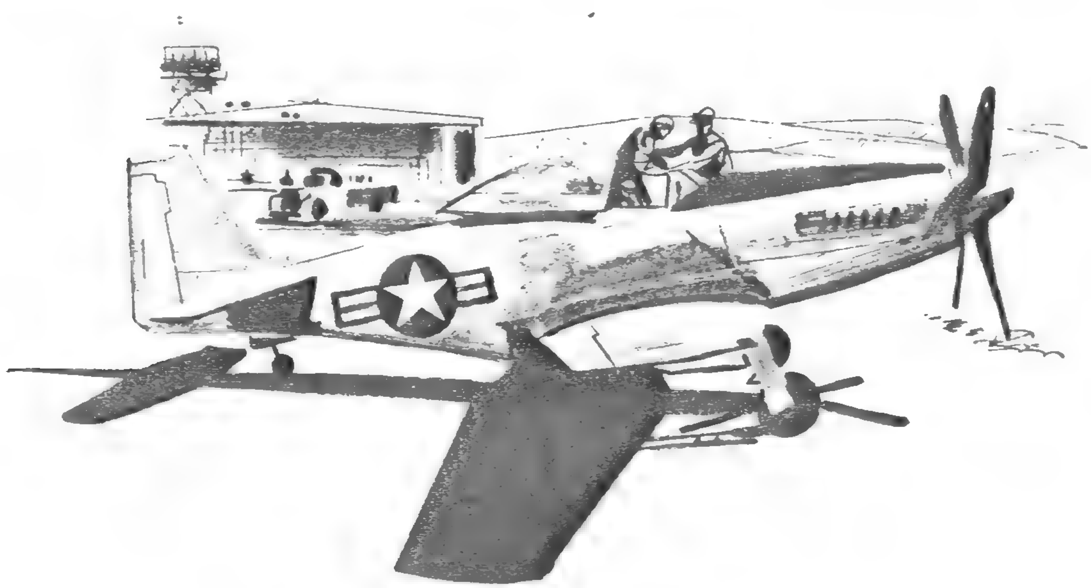
WARNING

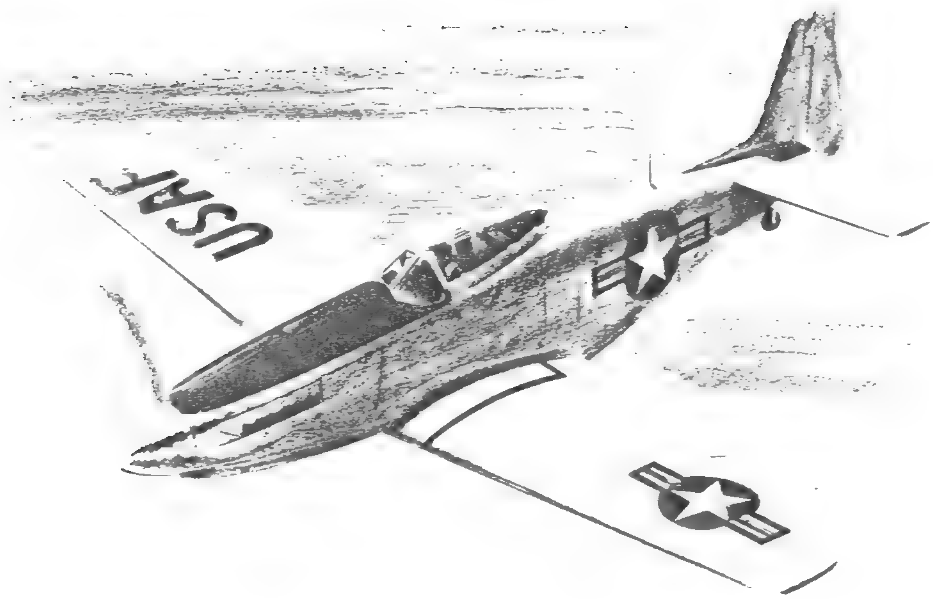
Do not advance throttle after moving mixture control to IDLE CUTOFF, to prevent runaway engine at next start.

5. Ignition switch OFF after engine stops firing.
6. Fuel tank selector handle OFF.
7. Radio off.
8. All electrical switches OFF.
9. Battery-disconnect switch OFF. Leave generator-disconnect switch ON.

BEFORE LEAVING AIRPLANE.

1. Have wheels chocked; then release brakes.
2. Controls locked.
3. Carburetor air control lever at FILTERED AIR.
4. Complete Form 1.
5. Close canopy.

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Emergency Procedures

ENGINE FAILURE.

Engine failures fall into two main categories: those occurring instantly, and those giving ample warning. The instant failure is rare and can be attributed to ignition system failure, fuel flow failure, or internal engine failure. Most engine failures are gradual and afford the alert pilot ample indication that he may expect an engine failure. An extremely rough-running engine, loss of oil pressure, excessive coolant temperature under normal flight conditions, loss of manifold pressure, and fluctuating rpm are indications that a failure may occur. When indications point to an engine failure that can't be corrected or diagnosed, the pilot should proceed to the nearest base and land immediately.

ENGINE AIR START.

If the engine fails in flight and sufficient altitude is available, a restart may be attempted, provided the engine did not stop for obvious mechanical reasons. Unless the engine seizes or internal structural failure occurs, the propeller will windmill even at minimum glide speed. Should the propeller stop windmilling, drop nose to regain flying speed and follow starting procedure given in Section II. Before attempting air restart with starter, make sure all electrical equipment is turned off.

ENGINE FAILURE DURING TAKE-OFF RUN.

Note

The chances of engine failure during take-off can be greatly reduced if engine is run up carefully and checked thoroughly during run-up before take-off.

If engine failure occurs during take-off run before the airplane leaves the ground, proceed as follows:

1. Close throttle completely.
2. Apply brakes as necessary to effect a quick stop.
3. If doubt exists as to whether airplane can be brought to a safe stop on runway, ignition switch OFF and fuel tank selector handle OFF.
4. If insufficient runway remains for a safe stop or obstacles cannot be avoided, move landing gear handle UP.
5. Roll canopy back or pull canopy emergency release handle.
6. Shoulder harness locked.
7. After stopping, get out of airplane as soon as possible, and remain outside.

ENGINE FAILURE DURING TAKE-OFF (AIRPLANE AIR-BORNE).

If engine fails completely immediately after take-off (figure 3-1), act quickly as follows:

1. Drop nose at once, so that airspeed does not drop below stalling speed.
2. If external fuel tanks or bombs are installed, pull bomb salvo and drop tank release handles immediately.
3. Release canopy by pulling canopy emergency release handle.

WARNING

Before emergency release of canopy in flight, drop seat and lower head as far as possible. If excessive force is used in securing canopy before take-off, it may be necessary to crank canopy back enough to relieve pressure against windshield to permit emergency release.

4. If there is reasonable doubt as to condition of terrain on which you are being forced to land, or if there is a probability of airplane nosing over or overrunning available landing area, move landing gear handle UP.
5. Flap handle at full DOWN if possible.
6. Move mixture control to IDLE CUTOFF and turn ignition switch OFF.
7. Turn fuel tank selector handle to OFF.
8. Turn battery-disconnect switch OFF.
9. Shoulder harness locked.

CAUTION

Be sure all switches that cannot be reached with shoulder harness locked are OFF before locking shoulder harness.

Figure 3-1

10. Land straight ahead, changing direction only enough to miss obstructions.

11. After landing, get out of airplane as quickly as possible and remain outside.

ENGINE FAILURE DURING FLIGHT.

If the engine fails during flight, the airplane may be abandoned, ditched, or brought in for a dead-stick landing. For a landing with the engine dead (figure 3-3) follow these instructions:

1. Drop nose at once so that airspeed does not drop below stalling speed.

2. If external tanks or bombs are installed, pull bomb salvo and drop tank release handles to release tanks or bombs if over an uncongested area.

3. Turn fuel tank selector handle to OFF. Battery-disconnect switch OFF except as needed for radio or lights.

4. Choose an area for landing. If near a landing field, notify tower. Judge your turns carefully and plan to land into wind.

5. Release canopy by pulling emergency release handle. Remember to lower seat and duck head.

6. If a long runway is available and if there is sufficient time and altitude to properly plan an approach, landing gear handle DOWN. *If landing under any other condition, keep gear up;* you stand less chance of injury by making a belly landing.

7. Flap handle at approximately 30°, saving the last 20 degrees to overcome possible mistakes in judgment. Flap handle full DOWN when proper landing is ensured.

8. Land into wind, changing direction only as necessary to miss obstructions.

9. After landing, get out of airplane as quickly as possible and remain outside.

MAXIMUM GLIDE.

Maximum glide distance, in event of dead engine, may be attained by gliding at an airspeed of 175 mph with gear and flaps up. If conditions permit, place propeller control in full DECREASE in order to reduce drag as much as possible and to minimize windmilling. (See figure 3-2.)

FORCED LANDING (DEAD ENGINE).

See figure 3-3.

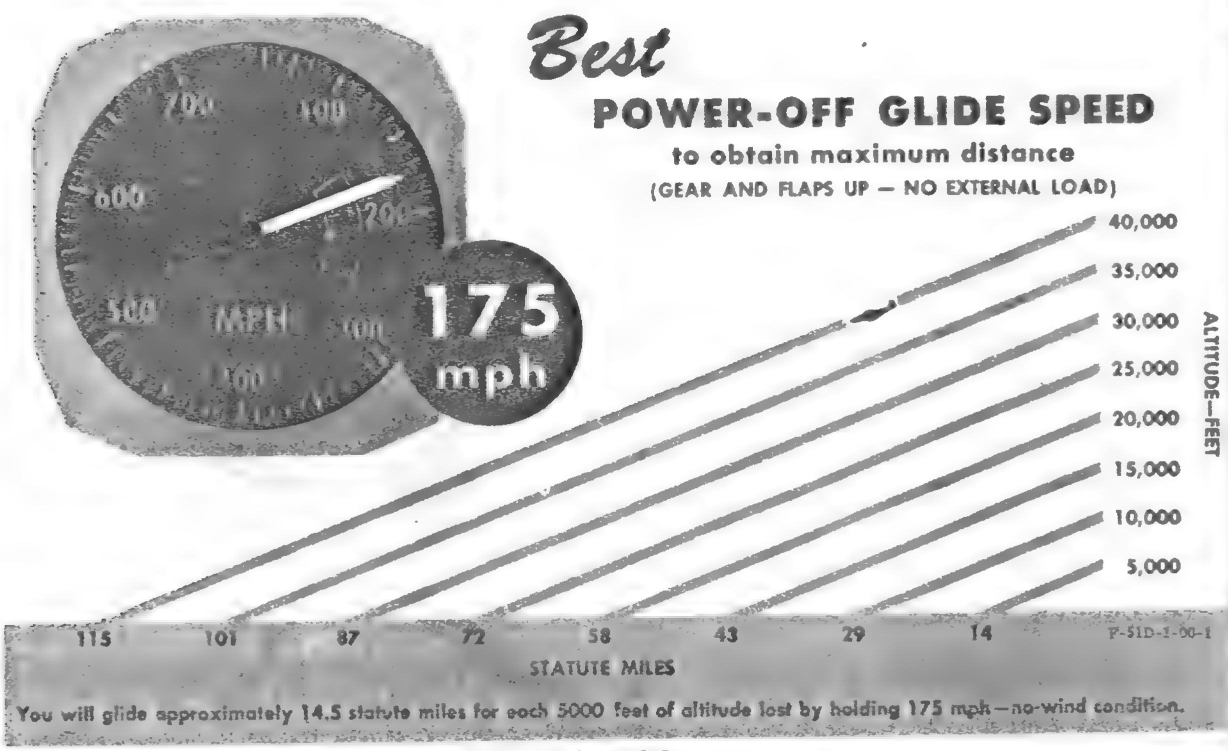


Figure 3-2

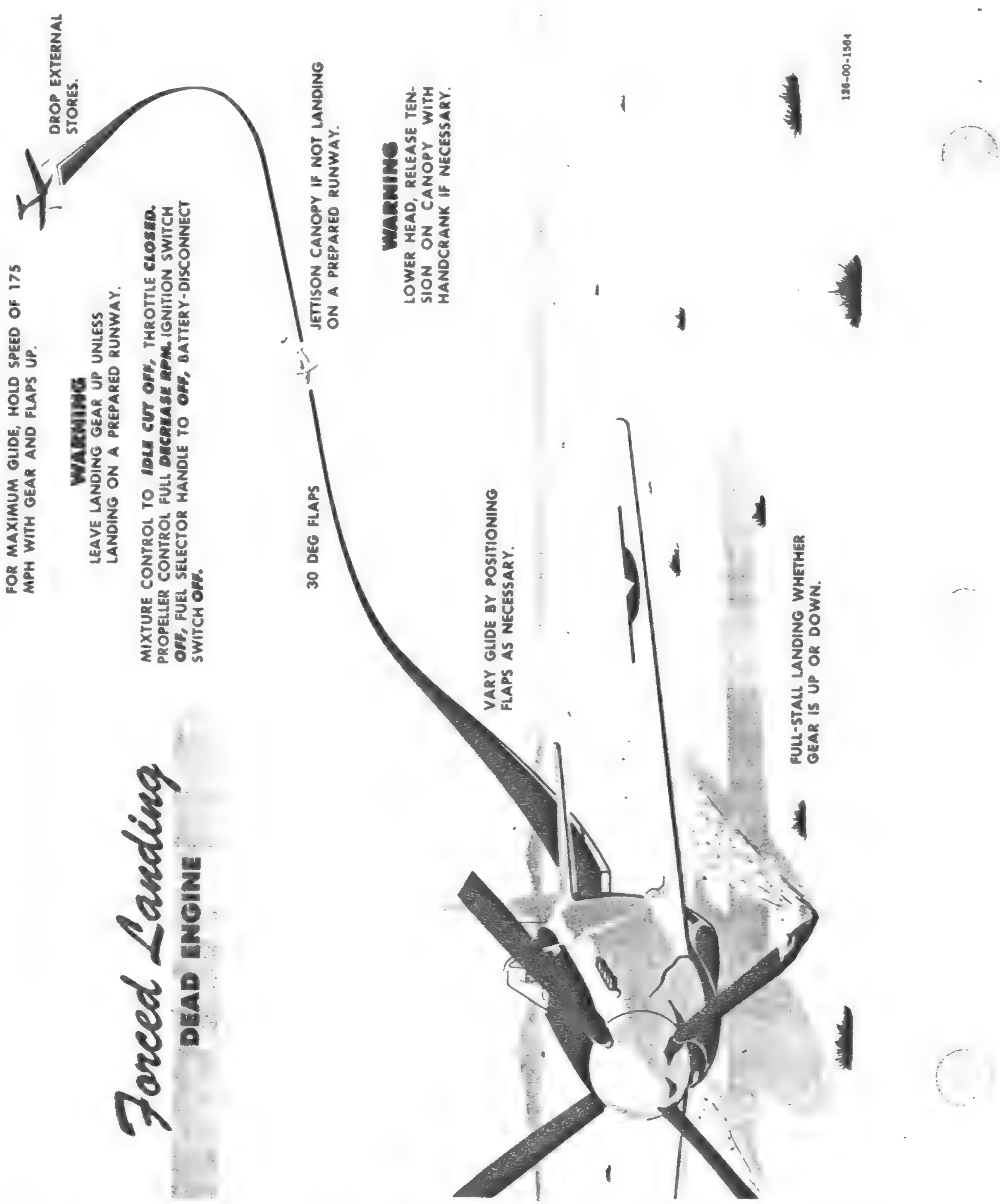

Forced Landing
DEAD ENGINE
DROP EXTERNAL STORES.
FOR MAXIMUM GLIDE, HOLD SPEED OF 175 MPH WITH GEAR AND FLAPS UP.
WARNING
LEAVE LANDING GEAR UP UNLESS LANDING ON A PREPARED RUNWAY.
MIXTURE CONTROL TO IDLE CUT OFF, THROTTLE CLOSED. PROPELLER CONTROL FULL DECREASE RPM. IGNITION SWITCH OFF, FUEL SELECTOR HANDLE TO OFF, BATTERY-DISCONNECT SWITCH OFF.
JETTISON CANOPY IF NOT LANDING ON A PREPARED RUNWAY.
WARNING
LOWER HEAD, RELEASE TENSION ON CANOPY WITH HANDCRANK IF NECESSARY.
30 DEG FLAPS
VARY GLIDE BY POSITIONING FLAPS AS NECESSARY.
FULL-STALL LANDING WHETHER GEAR IS UP OR DOWN.
126-00-1564

Figure 3-3

PRACTICE FORCED LANDING.

Forced landing can be simulated with the propeller control at full INCREASE to simulate the drag of a dead engine. Although optimum glide may be obtained with gear and flaps up, placing flaps 10 degrees down allows better visibility without seriously affecting airspeed or glide.

PROPELLER GOVERNOR FAILURE.

Failure of the governor to operate properly may result in a runaway propeller. A runaway propeller goes to full low pitch and may result in an engine rpm of 3600 or more. When such a failure occurs, the only method of reducing rpm is to pull the throttle back and decrease airspeed. In doing this, it is highly important to reduce the IAS to approximately 140 mph in order to obtain the maximum horsepower available. The following procedure is recommended:

1. Pull throttle back to obtain 3240 rpm.
2. Raise nose of airplane to lose speed, and then return to level-flight attitude. Keep IAS at approximately 140 mph.
3. When over landing area, lower gear and make approach at normal landing speed.

CAUTION

When engine speed and manifold pressure exceed allowable limits, the pilot should land at the nearest base and should record the duration of overspeed, the amount of overspeed, the manifold pressure, and (if known) the cause of overspeed.

FIRE.

ENGINE FIRE DURING STARTING.

If fire develops during starting, keep cranking engine in an attempt to blow fire out. If fire persists, use the following procedure:

1. Throttle CLOSED.
2. Mixture control IDLE CUTOFF.
3. Fuel tank selector handle OFF.
4. Battery-disconnect switch OFF.
5. Leave airplane as quickly as possible and signal ground crew to use portable fire-extinguishing equipment

ENGINE FIRE AFTER STARTING.

If fire develops after starting, it will probably develop in the carburetor area. Keep engine running to suck fire back into engine. If fire still persists, follow procedure in preceding paragraph.

ENGINE FIRE DURING FLIGHT.

Depending upon the severity of the fire, either bail out immediately or shut down engine as follows:

1. Mixture control IDLE CUTOFF.
2. Fuel tank selector handle OFF.
3. Throttle CLOSED.
4. Ignition switch OFF.
5. Battery-disconnect switch OFF except when power is necessary to operate lights or radio.

FUSELAGE FIRE.

1. Reduce airspeed immediately in preparation for bail-out (if it becomes necessary) and to lessen possibility of fire spreading.
2. If smoke or fumes enter cockpit, use 100 percent oxygen and open canopy.
3. Generator- and battery-disconnect switches OFF.
4. If fire persists, shut down engine as explained in preceding paragraph.
5. If fire is not extinguished immediately, bail out.

Note

There is no fire extinguishing system on this airplane.

WING FIRE.

If a wing fire develops, use the following procedure:

1. Turn off all switches to wings (i.e., position and landing light switches), armament switches, and pitot heater switch.
2. Attempt to extinguish fire by sideslipping airplane away from flames.
3. If fire is not extinguished immediately, bail out.

ELECTRICAL FIRE.

Circuit breakers protect most electrical circuits and automatically interrupt power to prevent fire if a short occurs. If the defective circuit can be identified, turn off the master switch for that circuit. If fire persists, turn battery-disconnect switch OFF. Turn generator-disconnect switch OFF if neither of the preceding is effective. Return to the nearest available landing field as soon as possible, or, if fire increases in intensity, bail out.

SMOKE ELIMINATION.

Should smoke or fumes enter the cockpit, proceed as follows:

1. Reduce airspeed in preparation for bail-out and to minimize spreading of fire.
2. Open cold-air outlets.
3. Open canopy.
4. If smoke or fumes are still severe, use 100 percent oxygen.

LANDING EMERGENCIES.

BELLY LANDING.

If an emergency arises where a belly landing is necessary, proceed as follows:

1. Pull bomb salvo and drop tank release handles to release external load.
2. Release canopy by pulling canopy emergency release handle. Remember to lower seat and duck head.
3. Flap handle at approximately 30°, saving the last 20 degrees to overcome possible mistakes in judgment.
4. Make normal approach and flare, and hold airplane off ground as long as possible.
5. Just prior to touchdown, switches OFF and shoulder harness locked.
6. After landing, get out of airplane as soon as possible.

EITHER GEAR UP OR UNLOCKED.

Ordinarily a wheels-up landing is preferable to a landing with only one wheel extended. However, if one wheel is extended and cannot be retracted, proceed as follows:

1. Pull bomb salvo and drop tank release handles.
2. Roll canopy full back.
3. Lock shoulder harness.
4. Make normal flaps-down approach with wing low on extended-gear side.
5. Touch down on locked main wheel and tail wheel simultaneously, using ailerons to hold up wing with unsafe wheel.
6. Ignition switch OFF.
7. Maintain ground control by use of steerable tail wheel, brake, and rudder.
8. When wing tip strikes ground, apply maximum brake pressure possible without nosing over.

LANDING GEAR AND FAIRING DOOR INTERFERENCE.

Should the landing gear handle be moved to UP before the landing gear has completed its down cycle, gear and fairing door interference may result. In this event, proceed as follows:

1. Place landing gear handle at DOWN. Observe gear-down maximum permissible IAS.
2. Hold flap handle forcibly above full up position. (Holding the flap handle at this position shuts off all the hydraulic pressure to the landing gear and fairing doors and permits the landing gear to fall free.)

Note

> Do not expect an immediate response, as it may take as long as 15 minutes to bleed off the hydraulic system, with the flap handle held up continuously during this period.

LANDING GEAR HANDLE LINKAGE BROKEN.

If the landing gear does not lower when the gear handle is placed at DOWN, the linkage to the landing gear selector valve may be broken. In this case, the landing gear can be lowered as follows:

1. Pull landing gear emergency release handle. (This positions the landing gear selector valve and releases uplocks to allow hydraulic pressure to operate the gear in the same manner as when the landing gear handle is used.)

EMERGENCY ENTRANCE.

An external canopy emergency release handle (figure 3-4) is located forward of the windshield bow on the upper right-hand longeron. Pulling the handle hard releases the canopy so that it may be removed from the airplane.

DITCHING.

The airplane should be ditched (figure 3-5) only as a last resort. If it is impossible to maintain sufficient altitude for bail-out, ditch according to the following procedure:

1. Follow radio distress procedure, giving location.
2. Jettison external load.
3. Unbuckle parachute; make sure life raft is fastened to you.
4. Pull canopy emergency release handle. Remember to lower seat and duck head.
5. Tighten safety belt and lock shoulder harness because of high final impact.
6. Disconnect headset, oxygen equipment, and anti-G suit. Make sure no personal equipment will foul on your way out.
7. Check gear up and flaps one-half down.
8. Land into wind with one wing about 20 degrees low, and maintain enough speed above stall to keep rudder control. As low wing hits water, kick hard inside rudder to spin airplane around on surface to prevent severe diving and quick deceleration. As soon as airplane comes to rest, get out immediately.

BAIL-OUT.

When the decision is made to abandon the airplane and time permits, jettison external load (bombs, rockets, or tanks) if the area below is uninhabited. Reduce airspeed as much as possible and trim to slightly nose-down attitude. Head for an uninhabited area and follow procedure shown in figure 3-6.

ALTERNATE BAIL-OUT.

When airplane is controllable, the following bail-out procedure is recommended:

1. Disconnect radio, anti-G suit, and oxygen connections (if not at altitude).
2. Pull canopy emergency release handle. Remember to lower seat and duck head.
3. Roll airplane over on its back and trim for inverted climb.
4. Release safety belt and harness, and drop clear.

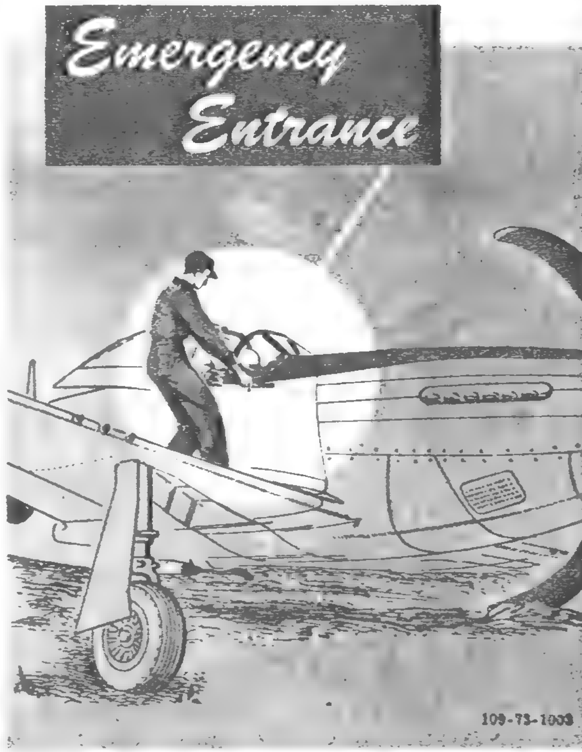


Figure 3-4

FUEL SYSTEM FAILURE.

If engine begins cutting out in flight and the fuel system is suspected, immediately change fuel tank selector handle. If condition still persists, then proceed as follows:

1. Release drop tanks if empty. (Air pressure from empty drop tanks may leak past the fuel selector valve and permit the engine fuel pump to suck air.)
2. Reduce altitude below 8500 feet. (The engine-driven fuel pump alone will supply fuel up to this altitude.)
3. If engine still cuts out after tanks are dropped, flight may possibly be continued at reduced power (1500 rpm) by use of the primer.

ELECTRICAL POWER SYSTEM FAILURE.

When the ammeter shows a constant reading of more than 75 amperes, either a very low-charged battery or a short circuit is indicated. Under these conditions, leave generator-disconnect switch ON, turn battery-disconnect switch OFF, and check as follows:

1. If ammeter reading goes down to normal, a low

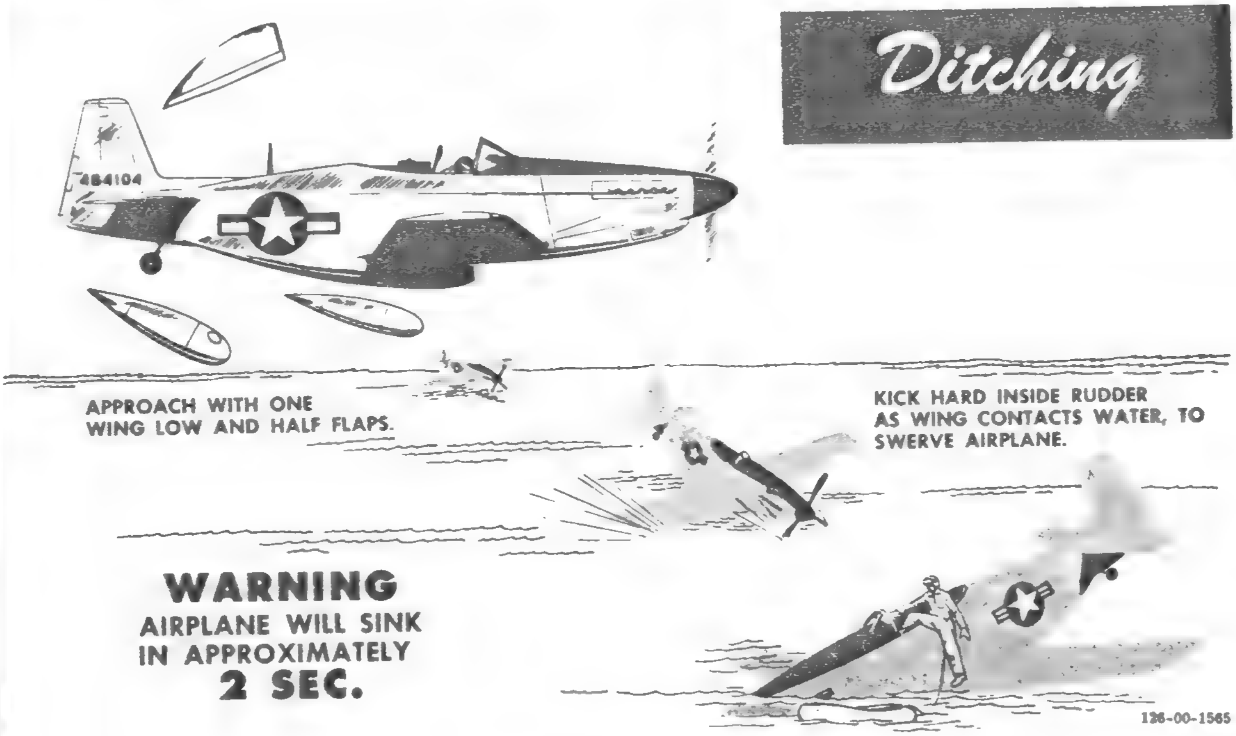


Figure 3-5

battery is indicated; turn battery-disconnect switch ON again, checking, however, to see that ammeter reading goes down as battery charge builds up.

2. If reading is still high and you are on ground, return to ramp.

3. If short cannot be found, turn off all electrical circuits, including battery- and generator-disconnect switches. Use electrical system only when necessary, such as for checking and adjusting coolant temperatures.

4. Land at nearest available field.

GENERATOR FAILURE.

If generator failure is suspected, the following method may be used for checking and continued operation.

1. Turn battery-disconnect switch OFF. If electrical equipment still operates, the generator is functioning. If electrical equipment operates and ammeter shows no reading, the ammeter is faulty. If electrical equipment fails to operate, the generator is inoperative.

2. Turn battery-disconnect switch ON. Use battery power only when it is necessary to adjust coolant shutters or any other necessary electrical equipment.

3. Land at nearest available field.

INVERTER FAILURE.

In case of inverter failure, the remote compass is unreliable and the stand-by compass must be used. No switch is provided to isolate the inverter circuit.

HYDRAULIC POWER SYSTEM FAILURE.

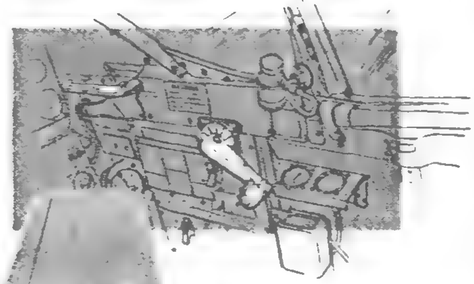
Hydraulic power system failure will affect operation of the landing gear and wing flaps. There is no hydraulic hand-pump in the cockpit. If the engine-driven hydraulic pump fails, the landing gear may be lowered as described in the following paragraph.

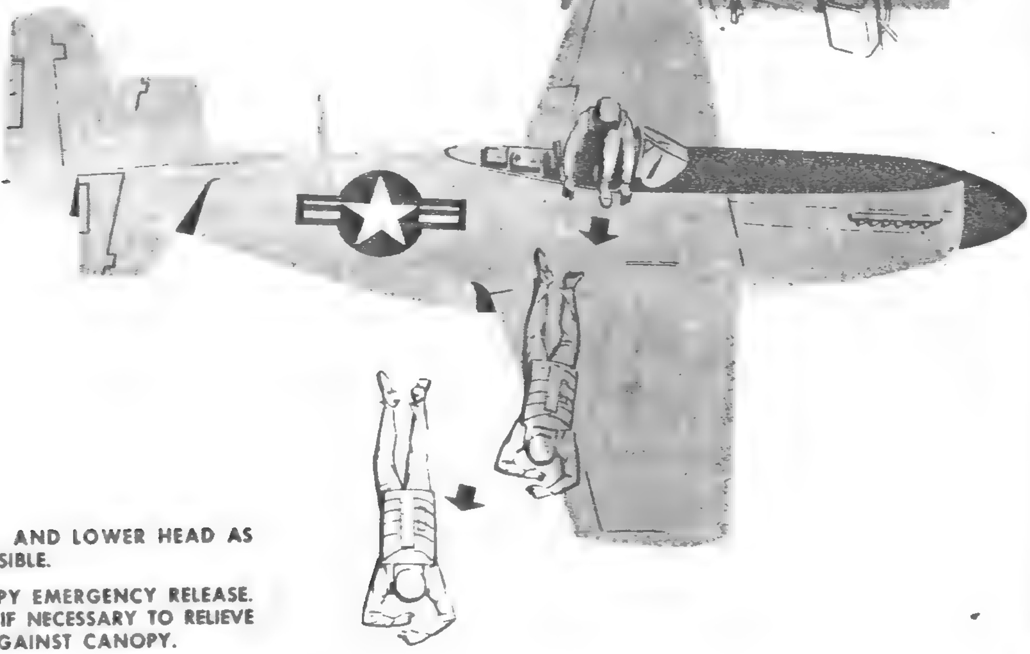
LANDING GEAR EMERGENCY OPERATION.

LANDING GEAR EMERGENCY LOWERING.

In event of hydraulic system failure, lower landing gear by placing landing gear control handle in DOWN position and yawing airplane. A spring bungee helps the gear to go to the downlocked position. However, if the red landing gear warning light comes on or the landing gear warning horn sounds when the throttle is retarded

Bail-Out PROCEDURE





1 DROP SEAT, AND LOWER HEAD AS FAR AS POSSIBLE.

2 PULL CANOPY EMERGENCY RELEASE. USE CRANK IF NECESSARY TO RELIEVE PRESSURE AGAINST CANOPY.

3 JUST BEFORE LEAVING AIRPLANE, IF AT ALTITUDE, PULL BALL RELEASE KNOB ON BAIL-OUT BOTTLE. IF TIME PERMITS, DISCONNECT OXYGEN HOSE AND HEADSET, AND THEN RAISE SEAT TO TOPMOST ELEVATION.

4 CROUCH AS SHOWN AND DIVE TOWARD RIGHT WING TIP.

NOTE: RIGHT SIDE IS RECOMMENDED BECAUSE THE SLIP STREAM WILL HELP YOU CLEAR THE AIRPLANE. THE WING WILL THEN PASS YOUR BODY, OR IT WILL BE POSSIBLE TO SLIDE OFF THE WING WITHOUT STRIKING THE TAIL.

WARNING BAIL OUT ON OUTSIDE OF A SPIN TO MINIMIZE DANGER OF BEING STRUCK BY AIRPLANE.

126-00-1566

Figure 3-6

(indicating an unsafe condition), pull landing gear emergency release handle and then yaw airplane to force gear into locked position.

If the landing gear does not extend after the landing gear emergency release handle is pulled, the following procedure, though not a positive solution, may produce the desired result:

1. Place landing gear handle at DOWN.

2. Pull wing flap handle upward forcibly to a position above the 0° position and hold it there. Do not expect an immediate reaction, as this procedure may take as long as 15 minutes. (Holding the wing flap handle in this position bleeds the hydraulic pressure from the landing gear and the fairing doors and permits them to drop free.)

LANDING GEAR EMERGENCY RETRACTION.

In the event it is necessary to retract the landing gear during a landing or take-off run, move landing gear

handle to UP position. The gear will retract as long as the airplane is in motion. The gear will not retract if the airplane is not in motion, even if the gear handle is placed in the UP position, as the hydraulic pressure does not have sufficient power to retract the landing gear while the airplane is stationary.

CANOPY EMERGENCY OPERATION.

An emergency canopy release handle is located on the upper right longeron, aft of the instrument panel. The handle is safetied with light-gage safety wire to prevent accidental operation. In emergency, jettison the canopy as follows:

1. Lower seat as far as possible.
2. Duck head and pull emergency canopy release handle.

WARNING

Be sure to lower seat and duck head to avoid being hit by the canopy.

Note

If excessive force was used to secure canopy before take-off, it may be necessary to crank the canopy back to relieve pressure against the windshield before emergency release is effective.

DROP TANK EMERGENCY RELEASE.

The droppable fuel tanks are released when both bomb salvo handles are pulled out.

ENGINE OVERHEATING.

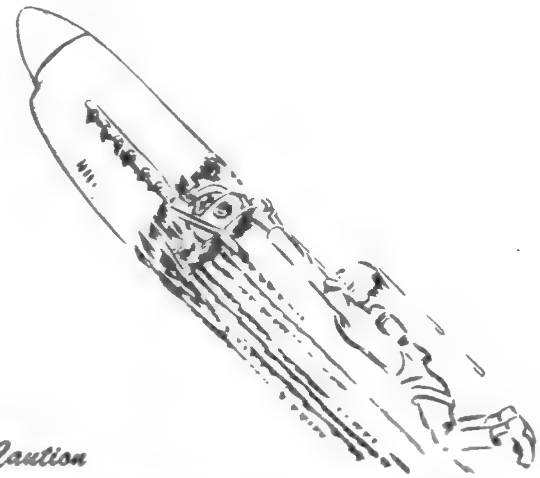
If engine overheats in flight (indicated by coolant relief valve pop-off exceeding maximum coolant temperature, or white smoke coming from exhaust stacks), move coolant flap control switch to OPEN and hold it there. If, after approximately 20 to 30 seconds, the temperature still remains high, failure of the coolant flap actuator is indicated. Release coolant flap control switch and pull coolant flap emergency release handle. Reduce power to minimum necessary to maintain flight altitude. If overtemperature persists, land as soon as possible.

CAUTION

If conditions are favorable for a dead-stick landing, and overtemperature persists, consider the possibility of shutting down the engine prior to landing.

If the high coolant temperature is not caused by actuator failure, an undesirable cooling condition may result from use of the emergency control. To check this possibility after using emergency release, hold coolant flap control switch to CLOSE for approximately 20 seconds. This ensures that the flap is not extended beyond 7 inches if the electrical actuator is functioning at all. Then move switch to OFF for remainder of flight.

When the coolant flap emergency release handle is used, low-power engine operation should be avoided, to prevent the coolant temperature from going below the minimum allowable as a result of the greater flap opening. There is no provision for emergency closing of the flap, nor can the emergency release be reset in flight.

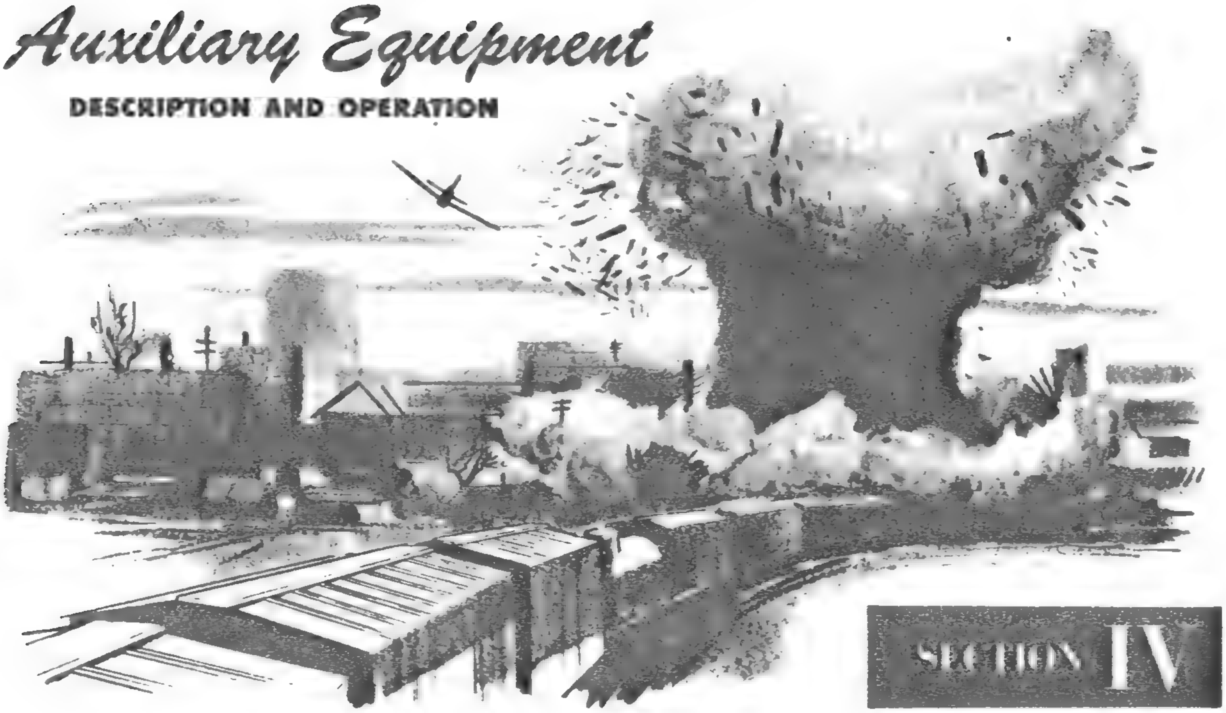


Caution

Use coolant flap emergency release with discretion. High coolant temperatures may be the result of high power settings, low-altitude flight, engine malfunction, or a broken indicator rather than actuator failure.

Auxiliary Equipment

DESCRIPTION AND OPERATION



COCKPIT HEATING AND VENTILATING SYSTEM.

An independent, pilot-operated heating and ventilating system (figure 4-1) is provided. The heating system is of the internal gas-combustion type that utilizes a 15,000 BTU per hour output heater operable at any altitude. The heating and ventilating system is controlled electrically and mechanically from the cockpit. Separate inlet ducts mounted on the leading edge of the left wing route combustion air and ventilating air to the heater. Ventilating air circulates through a cylindrical-type heating chamber surrounding the heater combustion chamber, becomes heated, and is then expelled to the modulator and distribution control valve. Fuel for operation of the heater is supplied from the carburetor. From the carburetor, fuel passes through a fuel strainer and a fuel pressure regulator and goes to the overheat solenoid shutoff valve, which if open permits the fuel to enter the heater fuel system. This fuel system consists of a restricting orifice and a full-flow solenoid valve. During low heater operation, the full-flow solenoid valve is closed. This permits fuel to go through the restricting orifice only, thus limiting the amount of fuel supplied to the combustion chamber. During high heater operation, fuel flows through the full-flow solenoid valve *and* the restricting orifice to the combustion chamber. Fuel enters the combustion chamber through a nozzle and is fed into one end of the heater onto a wick that surrounds an electrical glow plug. As the combustion air enters the combustion chamber and passes over the wick, it mixes with the fuel vapor and is ignited by the glow plug. The burned gases are exhausted through an outlet on the left side of the fuselage. A thermostatic switch and a ram-air pressure switch protect the system. If the air temperature exceeds 182°C (360°F) because of abnormal conditions, the thermostatic switch automatically closes an electrical circuit, causing the overheat solenoid shutoff valve to close. This shuts off fuel to the heater. If the ducts become obstructed and airflow is restricted, the ram-air pressure switch shuts off the heating system. Heating or ventilating air enters the cockpit through a controllable distributor valve located in the forward part of the cockpit. Ventilation is accomplished only when the heater unit is not in operation. An auxiliary ventilating system ducts cold air from the radiator air scoop to manually controlled air outlets below the longeron on each side of the cockpit.

COCKPIT HEATING AND VENTILATING CONTROLS.

COCKPIT HEATER SWITCH.

The three-position cockpit heater switch (figure 4-2), located on the front switch panel, electrically controls the combustion heater. Setting the switch to HIGH AND START starts the operating cycle by opening the full-flow

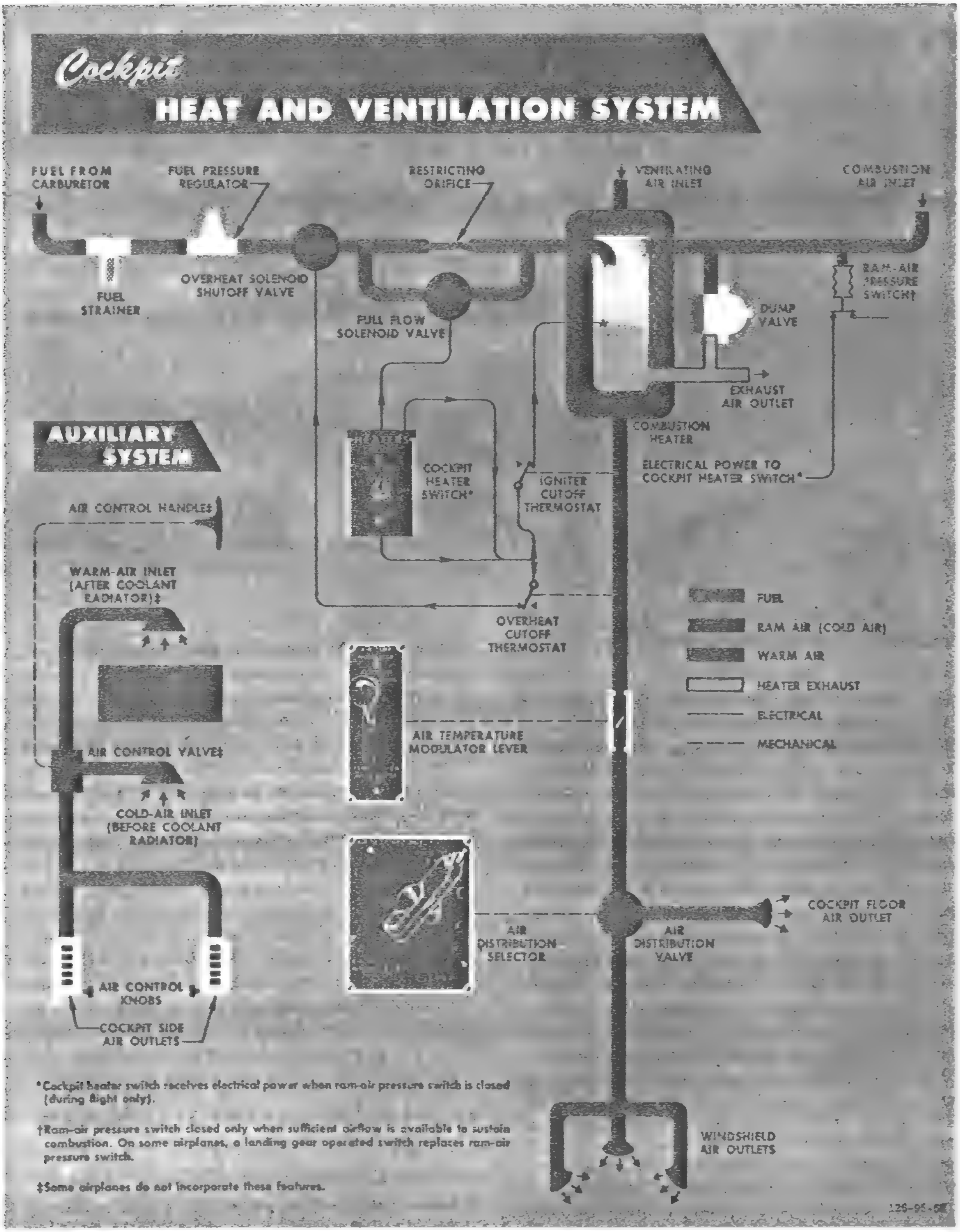

Cockpit
HEAT AND VENTILATION SYSTEM
FUEL FROM CARBURETOR
FUEL PRESSURE REGULATOR
RESTRICTING ORIFICE
VENTILATING AIR INLET
COMBUSTION AIR INLET
FUEL STRAINER
OVERHEAT SOLENOID SHUTOFF VALVE
FULL FLOW SOLENOID VALVE
RAM-AIR PRESSURE SWITCH†
DUMP VALVE
EXHAUST AIR OUTLET
COMBUSTION HEATER
ELECTRICAL POWER TO COCKPIT HEATER SWITCH*
AUXILIARY SYSTEM
COCKPIT HEATER SWITCH*
IGNITER CUTOFF THERMOSTAT
AIR CONTROL HANDLES‡
WARM-AIR INLET (AFTER COOLANT RADIATOR)‡
OVERHEAT CUTOFF THERMOSTAT
FUEL
RAM AIR (COLD AIR)
WARM AIR
HEATER EXHAUST
ELECTRICAL
MECHANICAL
AIR CONTROL VALVES‡
AIR TEMPERATURE MODULATOR LEVER
COLD-AIR INLET (BEFORE COOLANT RADIATOR)
COCKPIT FLOOR AIR OUTLET
AIR DISTRIBUTION SELECTOR
AIR DISTRIBUTION VALVE
AIR CONTROL KNOBS
COCKPIT SIDE AIR OUTLETS
*Cockpit heater switch receives electrical power when ram-air pressure switch is closed (during flight only).
†Ram-air pressure switch closed only when sufficient airflow is available to sustain combustion. On some airplanes, a landing gear operated switch replaces ram-air pressure switch.
‡Some airplanes do not incorporate these features.
WINDSHIELD AIR OUTLETS

Figure 4-1

solenoid valve. This provides extra fuel for starting and energizes the glow plug, which ignites the combustion mixture. The HIGH AND START position allows the heater unit to operate at full capacity; the LOW position electrically closes the full-flow solenoid valve and limits the amount of fuel admitted to the combustion chamber so that the unit operates at approximately one-half capacity by forcing the fuel to go through a restricting orifice. The OFF position shuts off the fuel at the overheat soleoid shutoff valve and de-energizes the heater unit.

AIR TEMPERATURE MODULATOR LEVER.

The air temperature modulator lever (figure 4-2), located on the control pedestal, has two positions, AUTOMATIC FOR HEATING and VENTILATION WHEN HEATER OFF. When the AUTOMATIC FOR HEATING position is selected and the heater unit is operating, heated air is available and is automatically controlled by the air temperature modulator valve. The modulator controls the amount of heated air passing to the distribution air valve. The modulator begins to open when the temperature of the air reaches 93°C (200°F) and is completely open when the temperature reaches 110°C (230°F). A thermostatic switch automatically opens and cuts off the heater if, because of abnormal conditions, the temperature exceeds 182°C (360°F). Then, as temperature drops, the thermostatic switch closes and completes the circuit again. The VENTILATION WHEN HEATER OFF position mechanically opens the air temperature modulator valve and is used for ventilation and cooling purposes when the heater is not operating.

AIR DISTRIBUTION SELECTOR.

The air distribution selector (figure 4-2), located on the control pedestal, permits routing heating or ventilating air to the desired outlets. The selector has four marked positions: AIR TO COCKPIT ONLY, AIR TO COCKPIT & WINDSHIELD, AIR TO WINDSHIELD ONLY, and AIR OFF TURN HEATER OFF.

COCKPIT HEATING AND VENTILATING *System Controls*

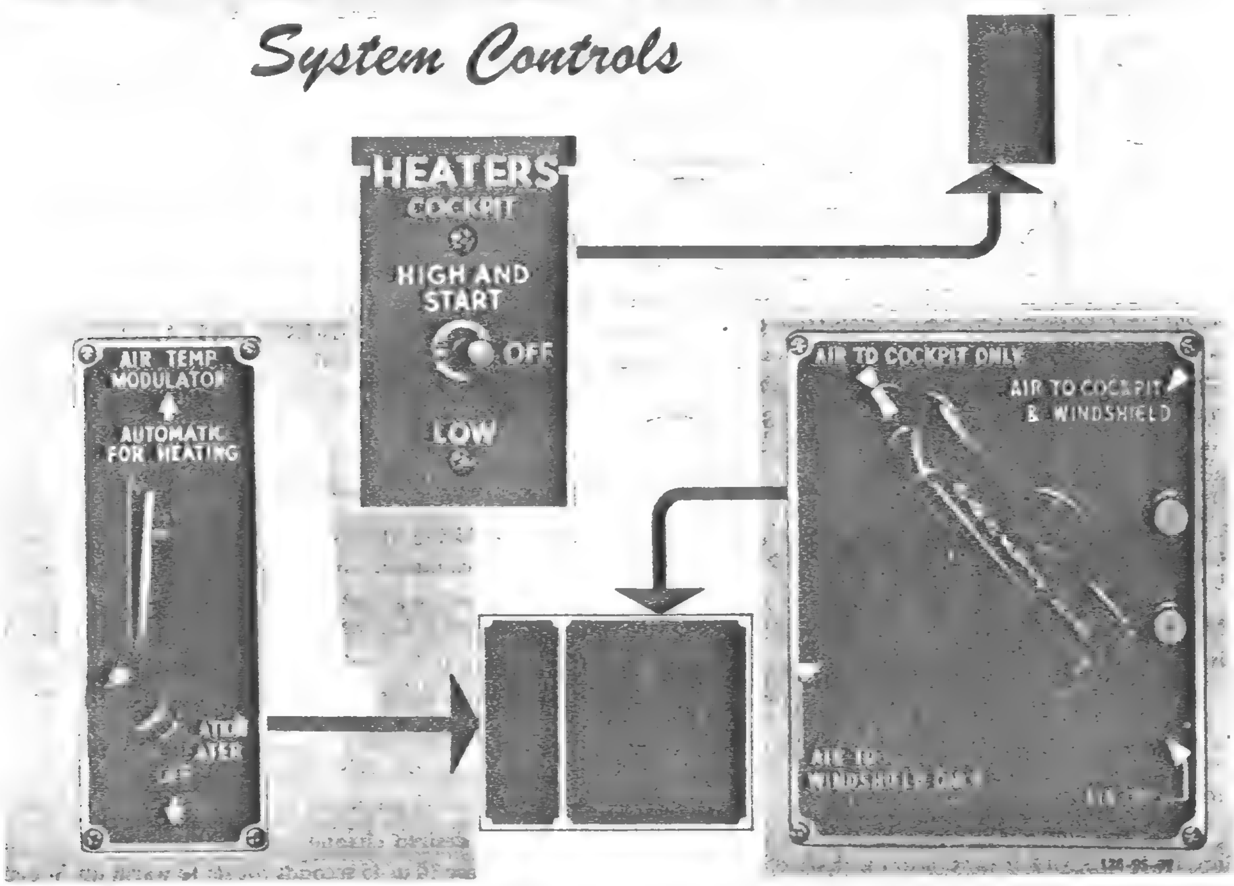


Figure 4-2

Caution

Never turn selector handle to AIR OFF, TURN HEATER OFF when heater is in operation, to prevent unnecessary operation of thermal switch.

SIDE AIR OUTLETS.

Two side air outlets (2, figure 1-5; 10, figure 1-6), located below the longerons on each side of the airplane, are manually operated to allow outside air to be ducted to the cockpit from the radiator air scoop. The outlets may be opened or closed to the desired position. On some airplanes, this system has been modified to allow warm air to be ducted to these outlets from the radiator scoop aft of the radiator. A mechanical push-pull handle, mounted alongside of the right side outlet, provides control for either warm or cold air. Pushing the handle in provides warm air, and pulling it out brings in cold air.

OPERATION OF COCKPIT HEATING AND VENTILATING SYSTEM.

Normal operation of the heating and ventilating system is accomplished as follows:

1. Air distribution selector set at desired position.
2. Air temperature modulator lever at AUTOMATIC FOR HEATING if heating is desired; VENTILATION WHEN HEATER OFF if ventilation is desired.
3. Cockpit heater switch at HIGH AND START if heating is desired; OFF if ventilation is desired.
4. If medium heating is desired, set cockpit heater switch at LOW *after* heater starts.
5. Adjust side air outlets as desired.
6. If windshield defrosting is desired, set cockpit heater switch at desired position (HIGH AND START or LOW), and set air distribution selector at AIR TO WINDSHIELD ONLY or AIR TO COCKPIT & WINDSHIELD, and air temperature modulator lever at AUTOMATIC FOR HEATING.

PITOT HEATER.

The pitot head is equipped with a conventional resistance-type electrical heater to prevent ice formation within the unit.

PITOT HEATER SWITCH.

The pitot heater is controlled by an on-off switch (23, figure 1-4; figure 4-8) located on the front switch panel.

CAUTION

The pitot heater switch should not be used on the ground, as the lack of air-flow will allow the heating elements to overheat.

COMMUNICATION AND ASSOCIATED ELECTRONIC EQUIPMENT.

TABLE OF COMMUNICATION AND ASSOCIATED ELECTRONIC EQUIPMENT.

See figure 4-3.

AN/ARC-3 VHF COMMAND SET.

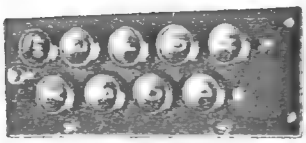
The AN/ARC-3 vhf command radio set provides two-way voice communication from airplane to airplane or from airplane to ground. The set has eight preset channels and has a line-of-sight range. Average range is approximately 30 miles at an altitude of 1000 feet and 135 miles at 10,000 feet. Range distances may increase or decrease with atmospheric changes.

OPERATION OF AN/ARC-3 COMMAND SET.

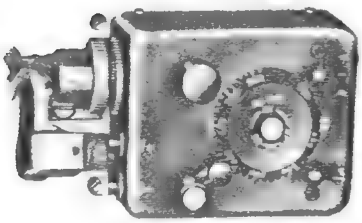
The AN/ARC-3 command radio is operated as follows:

1. Push desired channel selector button to turn set on, and allow 30 to 45 seconds for set to warm up. When audio noises heard in the headset clear, the set is ready for operation.

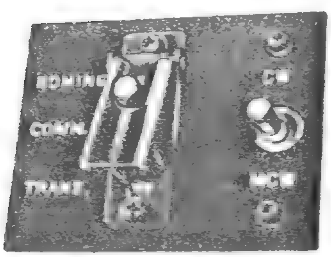
COMMUNICATION AND ASSOCIATED EQUIPMENT



AN/ARC-3

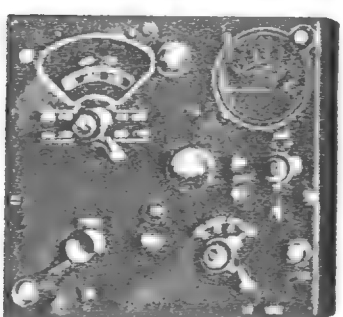


BC-453B

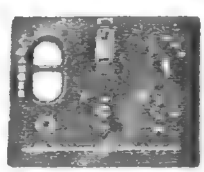


AN/ARA-8

TYPE	DESIGNATION	USE	RANGE	LOCATION OF CONTROLS
VHF COMMAND	AN/ARC-3	TWO-WAY COMMUNICATION	30 MI AT 1000 FT 135 MI AT 10,000 FT	RIGHT SIDE OF COCKPIT
RADIO RANGE RECEIVER	BC-453B	RECEPTION OF RADIO RANGE	50 TO 70 MILES	RIGHT SIDE OF COCKPIT
HOMING ADAPTER	AN/ARA-8	HOMING	30 MI AT 1000 FT 135 MI AT 10,000 FT	RIGHT SIDE OF COCKPIT
RADIO COMPASS	AN/ARN-7	RECEPTION OF VOICE, CODE, POSITION FINDING, AND HOMING	50 TO 100 MI FOR RANGE SIGNALS 100 TO 250 MI FOR BROADCAST SIGNALS	RIGHT SIDE OF COCKPIT
IFF RADAR	SCR-695A OR AN/APX-6	IDENTIFICATION	LINE OF SIGHT	RIGHT SIDE OF COCKPIT
TAIL WARNING RADAR	AN/APS-13	WARNS OF AIRCRAFT APPROACHING TAIL	LINE OF SIGHT	RIGHT SIDE OF COCKPIT



AN/ARN-7



SCR-695A

AN/APX-6

AN/APS-13

136-71-000

Figure 4-3

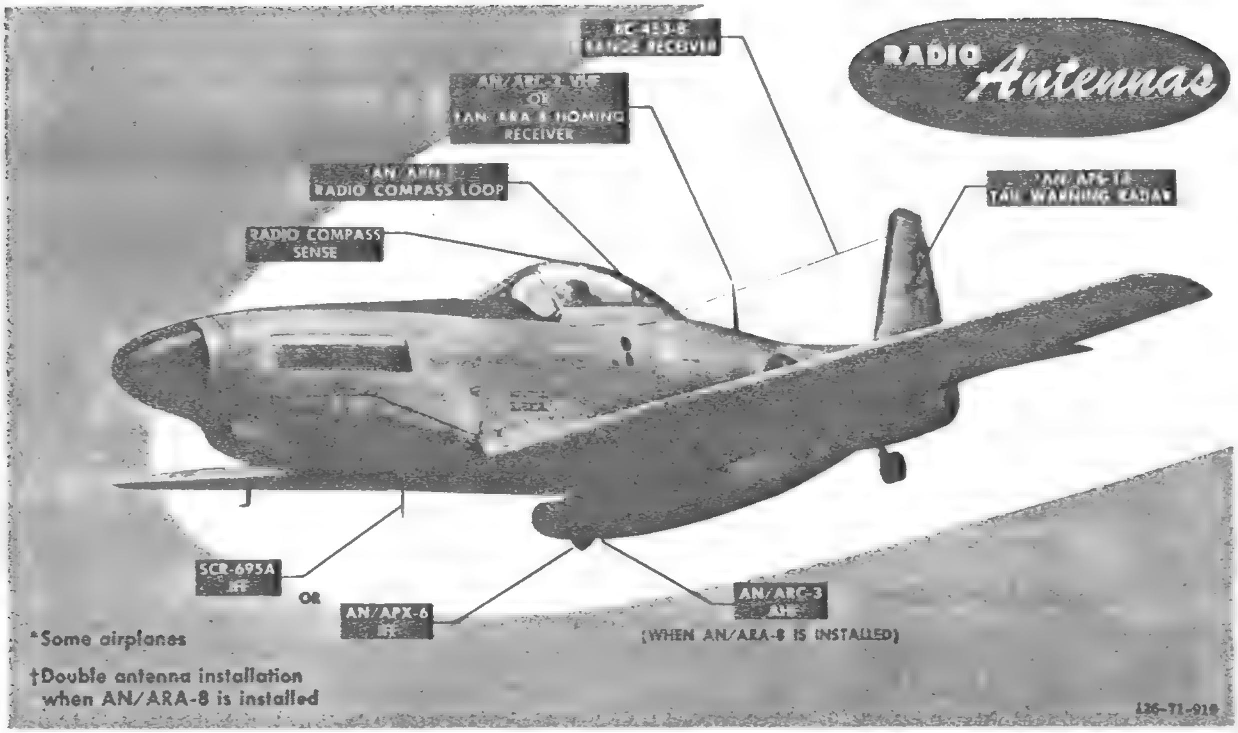


Figure 4-4

2. Adjust volume control as desired.

3. To transmit, press microphone button on throttle and use microphone.

4. To turn off command set, simultaneously push selector button marked "OFF" and small metal locking button located at forward end of channel selector buttons.

CAUTION

As the tuning mechanism is motor-driven, do not attempt to change frequency until the tuning cycle is complete. If a tuning cycle is interrupted by an attempt to change channels, the operating mechanism will not operate properly and may prevent further channel selection.

BC-453-B RADIO RECEIVER.

The BC-453-B radio receiver is for reception of radio ranges within the frequency range of 190 to 550 kc. Weather broadcasts and range instructions can be received also. Cranking the receiver dial to the desired frequency tunes the set.

OPERATION OF BC-453-B RADIO RECEIVER. The BC-453-B radio receiver is operated as follows:

1. Set "CW-OFF-MCW" switch, located on control box, to MCW for range reception.

2. Select desired frequency by rotating tuning control.

3. Adjust volume control as desired by turning "INCREASE OUTPUT" control.

4. For reception, select COMMAND position of interphone jackbox.

5. To turn set off, move "CW-OFF-MCW" switch to OFF.

AN/ARA-8 HOMING ADAPTER.

This adapter unit is used in conjunction with the AN/ARC-3 vhf equipment to permit homing on any transmitted carrier within the frequency range of 120 to 140 megacycles. Two receiving antennas mounted vertically side by side are located forward of the vertical stabilizer. Homing is accomplished by aligning the airplane with the station so that a null signal is received. If the airplane is not aligned with the station, a modulated signal is received. Range is limited to line-of-sight.

OPERATION OF AN/ARA-8 HOMING ADAPTER.

The AN/ARA-8 homing adapter is operated as follows:

1. Push desired channel selector button of AN/ARC-3 radio to turn set on, and allow 30 to 45 seconds for warm-up.
2. Place "HOMING-COMM.-TRANS." switch to HOMING position.
3. Adjust volume control of AN/ARC-3 radio for desired audio level.
4. Accomplish homing by bracketing null signal.
5. To return AN/ARC-3 radio to normal function and turn AN/ARA-8 adapter off, place "HOMING-COMM.TRANS." switch in COMM. position.

AN/ARN-7 RADIO COMPASS.

The AN/ARN-7 radio compass set (figure 4-3) is a visual and navigational aid used in conjunction with the radio compass indicator (1, figure 1-4), located on the instrument panel. The radio compass control panel is located on the cockpit floor, on the right side of the seat. Four separate frequency bands are provided: band one, 100 to 200 kilocycles; band two, 200 to 410 kilocycles; band three, 410 to 850 kilocycles; and band four, 850 to 1750 kilocycles. Controls permit selection of automatic or manual direction finding. A tuning meter on the compass control panel indicates strength and accuracy of tuning. The radio compass loop antenna is mounted within the aft portion of the canopy, and the sense antenna is incorporated in the dome of the canopy. (See figure 4-4.)

OPERATION OF AN/ARN-7 RADIO COMPASS.

Operate the radio compass as follows:

1. Turn selector switch from OFF to COMP, ANT., or LOOP.
2. Rotate band switch to desired frequency band range.
3. With selector switch at COMP, use tuning crank to tune in station and obtain maximum swing of tuning meter.
4. Turn volume control to adjust headset level.
5. Adjust index pointer by turning knob on compass indicator.
6. With selector switch at LOOP, use "LOOP L-R" switch to rotate loop to obtain maximum or minimum signal strength.
7. Return selector switch to OFF to turn radio compass off.

SCR-695-A IDENTIFICATION RADAR SET.

The SCR-695-A radar set and associated equipment permits automatic transmission of identification signals upon reception of a challenging signal from properly equipped friendly air or surface craft. It also may be used to transmit emergency or distress signals. The IFF controls include the following: a code selector which provides a choice of six code settings, an emergency switch for transmitting a distress signal, and an on-off control switch. The set is operable from sea level up to approximately 50,000 feet. Destructor units have been removed from this equipment.

OPERATION OF SCR-695-A IDENTIFICATION RADAR SET.

The SCR-695-A IFF set is operated as follows:

1. Rotate code selector to desired position.
2. Move "F" band on-off switch to ON position.
3. Move "G" band on-off-time switch to ON position.
4. If emergency or distress signal is needed, lift guarded switch to ON position.
5. To turn set off, move "F' band on-off switch to OFF; move "G" band on-off time switch to OFF.

AN/APS-13 TAIL-WARNING RADAR.

The AN/APS-13 radar set (if installed) provides a visible and an audible warning to the pilot of the presence or approach of airplanes from the rear. The warning system consists of a signal light mounted on the right side of the instrument panel shroud and a warning bell on the right side of the cockpit, adjacent to the pilot's seat. The radio set is located on the right side of cockpit, adjacent to the AN/ARC-3 radio. Controls for the set are on the forward end of the upper radio panel on the cockpit right side. The antenna system includes a vertical-stabilizer-mounted six-pronged antenna (three prongs protruding horizontally from each side). Range is line-of-sight.

OPERATION OF AN/APS-13 TAIL-WARNING RADAR.

To operate tail-warning radar, proceed as follows:

1. Turn AN/APS-13 switch ON; allow set to warm up for 3 minutes.
2. Hold test switch at ON. The warning light should illuminate, and the warning bell should sound.
3. To turn set off, place AN/APS-13 switch at OFF.

AN/APX-6 IDENTIFICATION RADAR.

The AN/APX-6 radar identification set (if installed) is used to automatically identify the airplane as friendly whenever it is properly challenged by suitably equipped friendly air or surface forces. The set also has provision for identifying specific friendly airplanes within a group and means for transmitting a special distress code.

Functionally, the AN/APX-6 set receives challenges and transmits replies to the source of the challenges, where the replies are displayed, together with the associated radar targets, on radar indicators. When a radar target is accompanied by a proper reply from the IFF set, the target is considered friendly. Three destructors, mounted in the AN/APX-6 transpondor, may be actuated by the pilot. An impact switch automatically actuates the destructors upon a crash landing.

OPERATION OF AN/APX-6 IDENTIFICATION RADAR.

Caution

Before take-off, check that AN/APX-6 frequency counters have been set to proper frequency channels.

1. To turn equipment on, rotate master control to NORM position (full sensitivity and maximum performance).

2. Rotate master control to STDBY to mtaintain equipment inoperative but ready for instant use.

Note

The LOW position of the master control (partial sensitivity) should not be used except upon proper authorization.

3. Set three-position "MODE 2" and "MODE 3" switches to their OUT and I/P positions unless otherwise directed.

4. For emergency operation, press dial stop and rotate master control to EMERGENCY position so that set will automatically transmit distress signals.

5. To manually fire destructors, lift guard and move destructor switch to ON.

6. To turn off IFF set, rotate master control to OFF.

7. If AN/APX-6 transpondor is destroyed during flight, report this information immediately after landing.

CAUTION

The destructors should be fired only when the AN/APX-6 equipment is in danger of falling into enemy hands. If a forced landing has to be made in an area of doubtful security, fire destructors.

LIGHTING EQUIPMENT.

EXTERIOR LIGHTING.

Exterior lighting consists of three position lights and a landing light. A position light is located on each wing tip, and one is faired into the rudder. A 250-watt, sealed-beam retractable landing light is installed in the wing, aft of the wheel well.

EXTERIOR LIGHTING CONTROLS.

POSITION LIGHT SWITCHES. The position lights are controlled by two toggle switches (22, figure 1-4; figure 4-8) located on the right side of the forward switch panel. The switch positions are DIM, OFF, and BRIGHT.

LANDING LIGHT SWITCH. The landing light is electrically extended and retracted by a reversible motor and controlled by a three-position switch (7, figure 1-5) on the left side of the cockpit, above the aileron trim control. The switch positions are EXTENDED AND ON, OFF, and RETRACT.

CAUTION

Keep ground operation of landing light to a minimum to prevent overheating and damaging the unit.

INTERIOR LIGHTING.

The interior lighting provision includes direct fluorescent lighting for the instrument panel, a cockpit

fluorescent light, and, on some airplanes, an additional adjustable ultraviolet lamp that is controlled by a switch mounted on the light.

INSTRUMENT PANEL AND COCKPIT LIGHT RHEOSTATS.

The rheostat controls (22; figure 1-4; figure 4-8) for the instrument panel and cockpit fluorescent lights are located on the right side of the forward switch panel. These controls have four marked positions: OFF, DIM, ON, and START. The rheostats must be rotated clockwise to the START position and held for a few seconds to start lamp illumination and then rotated counterclockwise to the desired position. The lens housing, on the light itself (5, figure 1-4), may be rotated to vary the brilliancy.

OXYGEN SYSTEM.

The low-pressure oxygen system is supplied from three Type F-2 cylinders installed in the top of the fuselage, aft of the cockpit. Included in the system is a diluter-demand regulator, a flow indicator, and a pressure gage. For combat safety, check valves are incorporated to prevent total loss of oxygen in the event of system failure or cylinder rupture. If a cylinder is punctured, it will be isolated by the check valves and the pressure indication will remain relatively the same, although the supply available will be reduced. The system is serviced by means of a single-point refilling valve located within an access door on the left side of the fuselage, aft of and above wing level. (See figure 1-16.) Normal minimum system pressure for take-off is 400 psi. An oxygen duration table is shown in figure 4-5.

Note

As an airplane ascends to high altitudes, where the temperature is normally quite low, the oxygen cylinders become chilled. As the cylinders grow colder, the oxygen gage pressure is reduced, sometimes rather rapidly. With a 100°F decrease in temperature in the cylinders, the gage pressure can be expected to drop 20 percent. This rapid fall in pressure is occasionally a cause for unnecessary alarm. All the oxygen is still there, and as the airplane descends to warmer altitudes, the pressure will tend to rise again, so the rate of oxygen usage may appear to be slower than normal. A rapid fall in oxygen pressure while the airplane is in level flight, or while it is descending, is not ordinarily due to falling temperature, of course. When this happens, leakage or loss of oxygen must be suspected.

Oxygen Duration —HOURS

COCKPIT ALTITUDE —FEET—	GAGE PRESSURE—PSI 400	350	300	250	200	150	100	BELOW 100
40,000	8.5 8.5	7.3 7.3	6.1 6.1	4.9 4.9	3.6 3.6	2.4 2.4	1.2 1.2	EMERGENCY—DESCEND TO ALTITUDE NOT REQUIRING OXYGEN
35,000	8.5 8.5	7.3 7.3	6.1 6.1	4.9 4.9	3.6 3.6	2.4 2.4	1.2 1.2	
30,000	6.3 6.3	5.4 5.4	4.5 4.5	3.6 3.6	2.7 2.7	1.8 1.8	0.9 0.9	
25,000	5.0 6.0	4.3 5.1	3.6 4.3	2.9 3.4	2.2 2.6	1.4 1.7	0.7 0.9	
20,000	4.1 6.7	3.5 5.8	2.9 4.8	2.3 3.9	1.7 2.9	1.2 1.9	0.6 1.0	
15,000	3.2 8.2	2.7 7.0	2.3 5.8	1.8 4.7	1.4 3.5	0.9 2.3	0.5 1.2	
10,000	2.7 10.8	2.3 9.3	2.0 7.7	1.6 6.2	1.2 4.6	0.8 3.1	0.4 1.5	

BLACK FIGURES INDICATE DILUTER LEVER ***NORMAL OXYGEN***
RED FIGURES INDICATE DILUTER LEVER ***100% OXYGEN***
CYLINDERS: THREE TYPE F-2

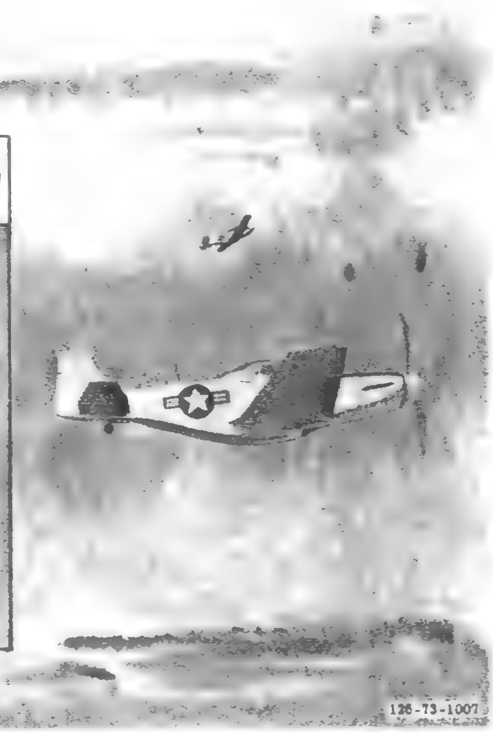


Figure 4-5

TYPE A-12 DILUTER-DEMAND OXYGEN REGULATOR.

The diluter-demand oxygen regulator (figure 4-6), located on the right side of the cockpit, controls the flow and dilution of the oxygen automatically. The regulator has normal and emergency controls.

WARNING

Use only a demand-type mask with a demand-type oxygen system.

A-12 OXYGEN REGULATOR CONTROLS.

DILUTER LEVER. The diluter lever has two positions, 100% OXYGEN and NORMAL OXYGEN. The lever should be at NORMAL OXYGEN all the time, except in emergency. With the lever in the NORMAL OXYGEN position, the regulator automatically supplies the correct proportions of air and oxygen for any flight altitude. The 100% OXYGEN position should be used only when symptoms of the onset of hypoxia occur or when fumes or smoke enters the cockpit. The lever should be returned to NORMAL OXYGEN as soon as the emergency is past.

REGULATOR EMERGENCY KNOB. If the regulator becomes inoperative, the emergency knob safety wire should be broken and the red knob at the regulator base rotated counterclockwise as indicated by the direction arrow. This allows 100% oxygen to by-pass the faulty regulator and feed directly to the mask.

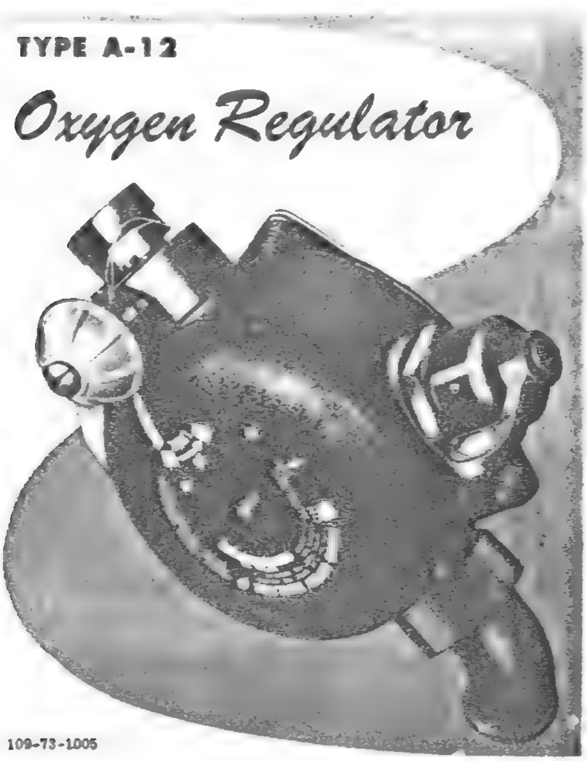


Figure 4-6

CAUTION

After emergency is over, set diluter lever to NORMAL OXYGEN and close emergency knob.

A-12 OXYGEN REGULATOR INDICATORS.

PRESSURE GAGE. An oxygen pressure gage is located below the lower right side of the cockpit edge. The gage is calibrated to read as high as 500 psi. For normal operation, the gage should show a minimum of 400 psi.

OXYGEN FLOW INDICATOR. The oxygen flow indicator, located on the right side of the cockpit, forward of the pressure gage, actuates a bellows assembly that opens and closes a yellow shutter on the face of the indicator to indicate normal oxygen system operation.

OXYGEN SYSTEM PREFLIGHT CHECK (TYPE A-12 REGULATOR).

Before each flight requiring the use of oxygen, check the system as follows:

1. Check that oxygen pressure gage shows a minimum pressure of 400 psi if flight above 10,000 feet or night flight is planned. If it is definitely known that a maximum flight altitude of 10,000 feet will not be exceeded or night flying is not contemplated, the pressure in the oxygen system must be at least 100 psi prior to flight. Should any doubt exist, however, as to adverse weather conditions that may be encountered on a long-range flight, the oxygen system must be charged to full capacity before take-off.

2. Check regulator diaphragm for leakage, with diluter lever set at NORMAL OXYGEN, by placing open end of mask-to-regulator tube against mouth and blowing lightly into it for about 5 seconds. Any escape of air from the regulator indicates either a leaky diaphragm or a faulty check valve in the air inlet, and the regulator must be replaced before flight.

3. Connect mask tube to regulator outlet. Check connection for tightness. Attach tube clip to parachute harness high enough to permit free movement of head without pinching or pulling face.

4. Check oxygen mask for fit and absence of leakage.

5. Breathe normally with oxygen regulator diluter lever at NORMAL OXYGEN, and then at 100% OXYGEN, to check flow indicator and flow from oxygen regulator.

6. Check oxygen regulator to see that emergency knob is safety-wired closed and that diluter lever is in NORMAL OXYGEN position.

TYPE A-14 PRESSURE-DEMAND OXYGEN REGULATOR.

The Type A-14 pressure-demand regulator automatically mixes air with oxygen in varying amounts, according to the altitude, and delivers a quantity of this mixture each time the user inhales. The percentage of oxygen furnished by the regulator increases with an increase in altitude and becomes 100% at approximately 34,000 feet. For operation above 30,000 feet, oxygen may be delivered under pressure.

WARNING

Use only a pressure-demand oxygen mask with the pressure-demand oxygen regulator.

A-14 OXYGEN REGULATOR CONTROLS.

DILUTER HANDLE. The oxygen regulator diluter handle, on the face of the pressure-demand regulator, is a manual control for selecting the oxygen-air mixing ratio. When the oxygen regulator diluter handle is set at NORMAL OXYGEN, the regulator automatically maintains the proper oxygen-air ratio for changes in altitude. When the handle is moved to the 100% OXYGEN position, the regulator delivers 100 percent oxygen regardless of the altitude.

PRESSURE-BREATHING KNOB. Clockwise rotation of the pressure-breathing knob on the face of the regulator from NORMAL delivers 100 percent oxygen under pressure. The knob should be rotated from NORMAL and set at SAFETY only above 30,000 feet or whenever the oxygen supply becomes inadequate. Whenever the pressure-breathing knob is not at NORMAL, the diluter mechanism is inoperative, and the resultant pressurized oxygen flow is uneconomical below 30,000 feet.

A-14 REGULATOR INDICATORS.

The A-14 regulator uses the same indicators as the A-12 regulator.

OXYGEN SYSTEM PREFLIGHT CHECK (TYPE A-14 REGULATOR).

Before take-off, check oxygen system as follows:

1. Check oxygen pressure gage (400 psi minimum) if flight above 10,000 feet or night flight is planned. If it is definitely known that a maximum flight altitude of 10,000 feet will not be exceeded or night flying is not contemplated, the pressure in the oxygen system must be at least 100 psi prior to flight. Should any doubt exist, however, as to adverse weather conditions that may be encountered on a long-range flight, the oxygen system must be charged to full capacity before take-off.

2. Set oxygen regulator diluter lever at 100% OXYGEN and pressure-breathing knob at NORMAL.

3. Blow gently back into mask-to-regulator line for about 5 seconds. There should be positive and continued resistance to blowing. Any indication of free passage through the regulator indicates a faulty air metering valve or diaphragm, and the regulator must be replaced before flight.

4. Connect mask tube to regulator outlet. Check connection for tightness. Attach tube clip to parachute harness high enough to permit free movement of head without pinching or pulling face.

A-14 OXYGEN REGULATOR NORMAL OPERATION.

For normal operation, the oxygen regulator diluter lever should be set at NORMAL OXYGEN and the pressure-breathing knob should be set as follows:

1. For cockpit altitudes below 30,000 feet, leave knob at NORMAL.

2. For cockpit altitudes between 30,000 and 40,000 feet, set knob at SAFETY.

3. For cockpit altitudes above 40,000 feet, set knob at cockpit altitude.

A-14 OXYGEN REGULATOR EMERGENCY OPERATION.

Oxygen system controls should be set as follows for various emergency conditions:

1. If symptoms of the onset of hypoxia occur or if smoke or fuel fumes enter cockpit, set oxygen regulator diluter lever to 100% OXYGEN.

2. If oxygen regulator becomes inoperative, pull cord of H-2 bail-out bottle and descend to an altitude where oxygen is not required.

Note

When emergency is over, set oxygen regulator diluter lever to NORMAL OXYGEN and pressure-breathing knob in accordance with procedure given in "A-14 Oxygen Regulator Normal Operation."

ARMAMENT.

The airplane has provision for armament which includes machine guns, gun sight, bomb and rocket carrying equipment, and gun camera. The armament equipment derives its power from the 28-volt direct-current electrical system.

GUNNERY EQUIPMENT.

Gunnery equipment consists of complete provisions for installation and operation of six fixed .50-caliber machine guns mounted in the wings. Each gun is provided

with a Type J-4 electric gun heater. Either of two gun installations is possible: (1) three fixed .50-caliber guns may be installed in each wing, with 390 rounds of ammunition for each inboard gun and 260 rounds for each center and outboard gun; or (2) the center gun may be removed, allowing the inboard guns to carry 390 rounds each and the outboard guns 490 rounds each. Ammunition containers are mounted in the wings; empty cases are ejected through the bottom of the wing. Gun charging is manually accomplished on the ground before flight. The guns are normally bore sighted down one to 2 degrees with reference to the fuselage centerline, with a point of convergence at 250 or 350 yards. A GSAP gun camera, installed in the leading edge of the left wing inboard of the guns, is operated automatically when the guns or rockets are fired and may be operated independently.

GUNNERY EQUIPMENT CONTROLS.

GUN SAFETY SWITCH. The guarded gun safety switch (38, figure 1-4), located on the left side of the front switch panel, has three positions: OFF; GUNS, CAMERA AND SIGHT; and CAMERA AND SIGHT. The GUNS, CAMERA AND SIGHT position allows the guns and camera to operate when the gun trigger is actuated and the sight is energized. This position should be selected only after the airplane is safely off the ground. The CAMERA AND SIGHT position should be selected when the camera and sight only are to be used, or to warm up the sight.

TRIGGER. The guns and camera are operated by the trigger (figure 1-6) on the stick grip. The trigger has two definite positions. When the gun safety switch is at GUNS, CAMERA AND SIGHT, pressing the trigger to the first position operates the camera only. Depressing the trigger to the second position actuates the camera and fires the guns. When the gun safety switch is at CAMERA AND SIGHT, only the camera operates at either of the two trigger positions.

GUN HEATER SWITCH. A gun heater switch (23, figure 1-4; figure 4-8), located on the forward switch panel, has ON and OFF positions to allow desired operation.

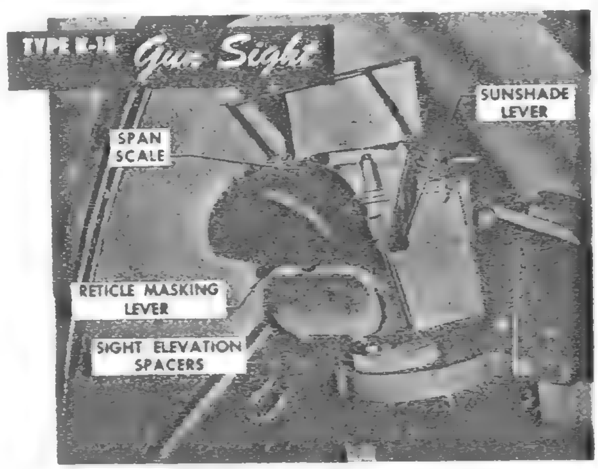
GUN CHARGER HANDLE. A gun charger handle is stowed in each wing gun bay for manually charging the guns before flight.

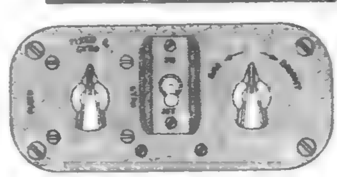
GUN CAMERA SYSTEM.

A gun camera is installed in the leading edge of the left wing, inboard of the guns. When the gun safety switch is positioned at either CAMERA AND SIGHT or GUNS, CAMERA AND SIGHT, pressing the trigger to either the first or second position operates the camera. When the switch is in the GUNS, CAMERA AND SIGHT position, the second trigger position also fires the guns. The camera may be adjusted for a few seconds overrun. The wing port for the camera lens has a spring-loaded hinged door that operates with the retraction of the landing gear. When the gear is extended, the hinged door closes, protecting the camera lens; when the gear is retracted, the hinged door is mechanically opened.

K-14A OR K-14B COMPUTING GUN SIGHT.

The airplane is equipped with either a K-14A or K-14B computing gun sight (figure 4-7), located above the instrument panel shroud. Both sights are basically the same. However, on the K-14A, the sight gyro motor has a separate switch; on the K-14B, the sight gyro motor is operated by the battery-disconnect switch. The sight computes the correct lead angle at ranges varying from 200 to 800 yards. The sight is equipped with two optical systems, fixed and gyro. The fixed optical system projects on the reflector glass a cross surrounded by a 70-mil ring. The 70-mil ring can be blanked out by the reticle masking lever. Normally blanked out, the ring is used only in case of mechanical failure of the gyro or for ground strafing. The gyro optical system projects on the reflector glass a pattern of six diamonds surrounding a central dot. The size of the diamond pattern is varied by changing the setting of the span scale lever on the face of the sight and by rotating the throttle twist grip.





① ② ③

SELECTOR DIMMER CONTROL PANEL
(Located on floor below throttle quadrant)

1. Gyro selector switch
2. Gyro motor switch (K-14A only)
3. Sight dimmer rheostat

F-51H-1-41-1

Figure 4-7

K-14A OR K-14B SIGHT CONTROLS.

GUN SAFETY SWITCH. Refer to "Gunnery Equipment Controls" in this section.

GYRO MOTOR SWITCH. The K-14A sight gyro motor is controlled by the gyro motor switch (2, figure 4-7), located on the floor of the cockpit, below the throttle quadrant. This switch has ON and OFF positions. The gyro motor on the K-14B sight is controlled by the battery-disconnect switch, and the motor is energized whenever the battery-disconnect switch is ON.

SIGHT DIMMER RHEOSTAT. The sight dimmer rheostat (3, figure 4-7), located on the cockpit floor, below the throttle, is mounted on the sight selector dimmer switch assembly. The rheostat controls the brilliancy of the sight reticle images and has DIM and BRIGHT positions. Clockwise rotation of the rheostat increases the intensity of the reticle, and counterclockwise movement decreases the intensity.

GYRO SELECTOR SWITCH. The gyro selector switch (1, figure 4-7) is mounted on the selector dimmer panel assembly, located on the cockpit floor below the throttle. The switch has three marked positions: FIXED, FIXED & GYRO, and GYRO. Since the sight is of the compensating and fixed type, the three switch positions allow the sight to be used as a fixed, combined fixed and compensating, or a compensating type only. The FIXED position is a caged position and is for ground use or for use in case of gyro failure. Either the FIXED & GYRO or the GYRO position should be used for all normal sightings. The FIXED position should be used for landing, to prevent damage to the gyro.

THROTTLE TWIST GRIP. A twist grip incorporated in the throttle (10, figure 1-5) permits range adjustment of the sight reticle image during gunnery operation. Clockwise rotation of the twist grip decreases the range (enlarges the reticle image); counterclockwise rotation increases the range (decreases reticle diameter). The twist grip is spring-loaded to the full counterclockwise position.

SPAN ADJUSTMENT LEVER. Positioning the span adjustment lever (figure 4-7) on the sight head inserts target size data into the sight, varying the reticle image circle diameter in proportion to the target size. Graduated markings (30 to 120) on the span dial represent the wing span, in feet, of the target airplane. The span adjustment lever should be set to a number on the dial corresponding to the wing span of the target airplane.

RETICLE MASKING LEVER. The fixed-reticle masking lever (figure 4-7), on the left side of the sight head, permits the 70-mil reticle circle to be blanked out, leaving only the central cross. The masking lever is used for ground operation or in case of gyro failure.

PREFLIGHT CHECK OF K-14A OR K-14B GUN SIGHT.

Before take-off, check the sight as follows:

1. Gun safety switch at CAMERA AND SIGHT.

2. Gyro selector switch at FIXED & GYRO. Both reticle images should appear on the reflector glass.

3. Rotate sight dimmer rheostat to obtain desired reticle brilliance.

4. Pick a point on horizon; make sure gyro reticle image dot is superimposed on fixed-reticle cross.

5. Rotate throttle twist grip to check operation of gyro reticle image circle from minimum to maximum range.

FIRING GUNS WITH K-14A OR K-14B GUN SIGHT INSTALLED.

Normal flight operation of the sight is accomplished as follows:

1. Gun safety switch at GUNS, CAMERA AND SIGHT.

2. Identify target; then set span adjustment lever to correspond with span of target airplane.

3. Fly airplane so that target appears within gyro reticle circle, and rotate throttle twist grip until diameter of gyro reticle circle corresponds to target size.

4. Frame target with gyro reticle circle by rotating twist grip as range changes. Track target smoothly for one second; then fire.

Note

The gyro sight computes correctly only after the target has been properly framed and tracked for a minimum period of one second.

5. Continue ranging and tracking while firing.

BOMBING EQUIPMENT.

A removable, external bomb rack can be installed on the lower surface of each wing. Each bomb rack will carry a single bomb from 100 or 1000 pounds; a droppable fuel tank of 75-, 110-, or 165-gallon capacity; a chemical tank; or a cluster of fragmentation or incendiary bombs. The bomb release system consists of an electrical and a mechanical mechanism. Normally, the bombs are released electrically. Bomb arming is selectively controlled by switches on the forward switch panel. The bombs cannot be armed if released mechanically. Bombs are aimed before release by use of the gun sight, with the gyro selector switch at FIXED.

BOMBING EQUIPMENT CONTROLS.

BOMB-ROCKET SELECTOR SWITCH. A bomb-rocket selector switch (37, figure 1-4; figure 4-8) is located with the armament switches on the left side of

the front switch panel. The switch has four marked positions: OFF, ROCKETS, ALL, and TRAIN. The ROCKET position completes the rocket-firing circuit. The ALL position allows both right and left bombs to be dropped simultaneously when the bomb-rocket release button is depressed. The TRAIN position permits the left bomb to drop first when the bomb-rocket release button is depressed. When the button is depressed again, the right bomb drops.

Note

When the ROCKET position is selected, the bombing circuits are inoperative.

BOMB ARMING SWITCHES. The two bomb arming switches (37, figure 1-4; figure 4-8), marked "LEFT" and "RIGHT," respectively, are located with the armament switches on the left side of the front switch panel. One switch is for the left bomb; the other, for the right bomb. The switches have three positions: OFF, CHEMICAL, and ARM. When bombs are carried, the CHEMICAL position should not be used. For nose and tail arming of the bombs, the ARM position is selected. For tail arming only, the adjustment must be made at time of loading. The CHEMICAL position is used only when chemical tanks are carried. The tanks may be discharged either singly or simultaneously. Chemicals are released when the bomb-rocket release button is depressed. The OFF position permits bombs to be dropped safe.

CAUTION

- The ARM position must not be used when chemical tanks are installed.
- The bomb-rocket selector switch must be OFF when chemical tanks are carried; otherwise, the chemical tanks will drop when the release button is depressed.

BOMB-ROCKET RELEASE BUTTON. The bomb-rocket release button is located on top of the control stick grip. Depressing the button fires rockets or releases bombs (tanks) as selected by the bomb-rocket selector switch.

BOMB SALVO AND DROP TANK RELEASE HANDLES. Two bomb salvo and drop tank release handles (13, figure 1-5), located aft of the instrument panel on the left side of the cockpit, can be used to release the bombs manually in the event of failure of the normal electrical release. The handles are mounted side by side and may be operated simultaneously or individually, as desired. The handles are marked "BOMB SALVO LEFT" and "BOMB SALVO RIGHT." The salvo handles mechanically release the bombs in the unarmed condition only or release the drop tanks.

RELEASING BOMBS.

The following procedure may be used to release bombs:

1. Move bomb arming switches to ARM position.
2. Move bomb-rocket selector switch to ALL for a simultaneous release or to TRAIN for individual bomb release.
3. Depress bomb-rocket release button momentarily to release bombs. (If bomb-rocket selector switch is at TRAIN, actuate release button twice in order to drop both bombs.)

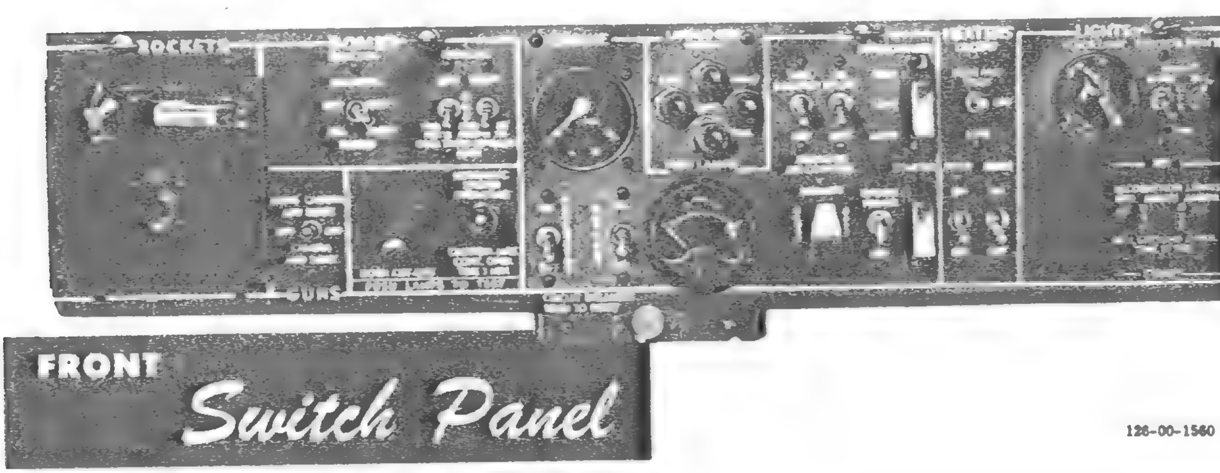
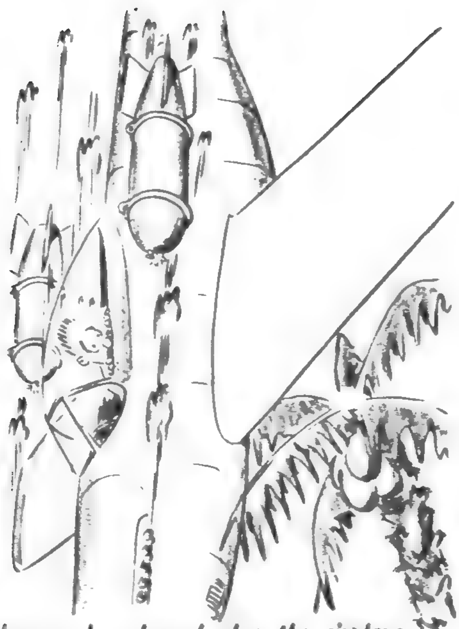


Figure 4-8



Note

Bombs may be released when the airplane is in any pitch attitude from a 30-degree climb to a vertical dive.

4. After bomb drop, move bomb arming switches to OFF and move bomb-rocket selector switch to OFF.

CAUTION

Don't release bombs when you are sideslipping more than 5 degrees in a vertical dive, because of danger of released bombs striking propeller.

ROCKET EQUIPMENT.

The airplane is equipped to carry 10 zero-rail rockets beneath the wings. If bombs or drop tanks are to be carried, only six rockets can be carried. The rockets are individually bore sighted. Rocket firing is accomplished through electrical switches mounted on the rocket switch panel and control stick grip. Rockets are aimed by use of the rocket scale on the fixed-reticle portion of the K-14A or K-14B gun sight. There is no rocket emergency release system.

ROCKET EQUIPMENT CONTROLS.

BOMB-ROCKET SELECTOR SWITCH. For rocket firing, the bomb-rocket selector switch, located on the front switch panel (figure 4-8), is used in conjunction with the rocket control panel (figure 4-8), and should be at ROCKETS. This completes the rocket-firing circuit. Setting the rocket control panel as desired releases rockets when the bomb-rocket release button on the control stick is pressed.

Note

When the bomb-rocket selector switch is at ROCKETS, the bomb release circuits are inoperative.

ROCKET RELEASE SWITCH PANEL. Rocket-firing sequence is controlled by means of an intervalometer and release control switches (39, figure 1-4; figure 4-8) located on the front switch panel. When the rocket selector switch is set at SINGLE, one rocket is released each time the bomb-rocket release button is depressed, and the intervalometer automatically maintains correct firing sequence for each successive release. When the selector switch is set at AUTO and the release button depressed, the intervalometer causes the rockets to be fired in proper sequence at approximately $\frac{1}{10}$-second intervals as long as the release button is held depressed. A numbered dial, visible through a window in the intervalometer housing, indicates the rocket to be fired. The dial is set at the time of rocket loading and should be set at 1 for every new rocket loading. The reset knob is used to select release of any particular rocket in case of misfire or other malfunction during a "single" release. Only rockets 1, 2, 3, 4, 5, and 6 are installed when bombs are carried.

ROCKET SELECTOR SWITCH. The rocket selector switch (39, figure 1-4; figure 4-8), located on the rocket switch panel, has three positions: OFF, SINGLE, and AUTO. The SINGLE position allows one rocket to be fired each time the release button is depressed; the AUTO position allows all rockets to be fired in train when the button is held depressed for approximately one second.

ROCKET ARMING SWITCH. The rocket arming switch (39, figure 1-4; figure 4-8), located on the rocket switch panel, has two positions: DELAY and INST. The INST. position permits the rockets to explode on impact, while the DELAY setting permits an explosion approximately 0.015 second after impact.

BOMB-ROCKET RELEASE BUTTON. For rocket firing, depressing the bomb-rocket release button on the top of the control stick will release rockets, either one at a time or all rockets in train, provided the bomb-rocket selector switch is at ROCKETS and the rocket switch panel is set as desired.

FIRING ROCKETS.

The following procedure should be used to fire the rockets:

1. Gun safety switch at GUNS, CAMERA AND SIGHT.
2. Gyro selector switch set at FIXED.

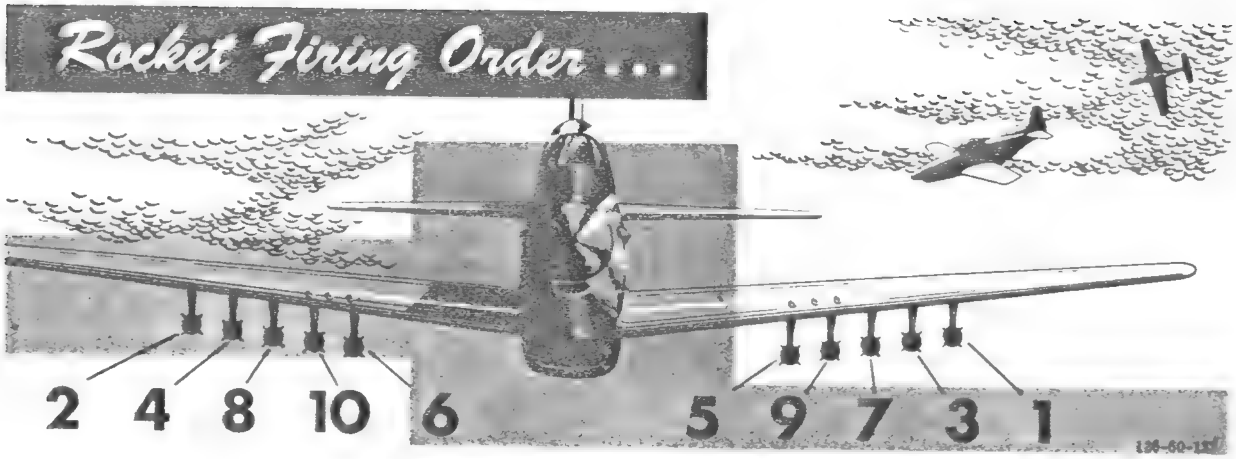


Figure 4-9

3. Sight-dimmer rheostat adjusted to give desired reticle intensity.

4. Rocket projector release control set at 1; rocket arming switch at DELAY or INST. as desired; bomb-rocket selector switch at ROCKETS; rocket selector switch at SINGLE or AUTO as desired.

5. Make approach on target that will give desired dive angle during firing.

6. Put reticle circle on target and frame properly.

7. Using throttle twist grip, adjust for range. Track target smoothly for approximately 3 seconds; then depress bomb-rocket release button to fire rockets.

Note

If rocket selector switch is at SINGLE, the bomb-rocket release button must be actuated each time a rocket is to be fired. If the switch is at AUTO, holding the release button depressed for approximately one second fires all rockets.

CHEMICAL TANK EQUIPMENT.

A chemical tank may be carried on each bomb rack in lieu of bombs. Two switches on the left side of the front switch panel allow selective release of chemicals (by means of the bomb-rocket release button).

CAUTION

When chemicals are to be released, the bomb-rocket selector switch must be OFF to prevent dropping tanks.

After release of chemicals, the tanks may be dropped by moving the bomb-rocket selector switch to the ALL position and depressing bomb-rocket release button.

CHEMICAL TANK EQUIPMENT CONTROLS.

BOMB ARMING SWITCHES. The two bomb arming switches (37, figure 1-4; figure 4-8), marked "LEFT" and "RIGHT," are located with the armament switches on the left side of the front switch panel. The switches have three positions: OFF, CHEMICAL, and ARM. When chemical tanks are installed, only the CHEMICAL position is used. This position causes chemicals to be released when the bomb-rocket release button on the control stick is momentarily depressed. The chemical tanks may be discharged singly or simultaneously, depending on whether the right or left arming switch or both switches are placed at CHEMICAL.

CAUTION

The ARM position must not be used when chemical tanks are installed, to prevent inadvertent discharge of chemicals.

MISCELLANEOUS EQUIPMENT.

ANTI-G SUIT PROVISIONS.

Air pressure outlet connection (3, figure 1-5) on the left side of the pilot's seat provide for attachment of the air pressure intake tube of the anti-G suit. Air pressure for inflation of the anti-G suit bladders is supplied from the exhaust side of the engine-driven vacuum pump and is regulated by a Type M-2 valve. The valve serves as a junction point for pressures exerted in both the droppable combat fuel tanks and the anti-G suit. If combat tanks are installed on the airplane, the acceleration force (G-load) required to actuate the M-2 valve should be approximately 3 to 3½ G because of

the approximately 5 psi pressure exerted in the tanks. Without the combat tanks installed, the valve should open at 2 G. After the valve opens, pressure is passed through a regulator valve into the suit in proportion to the G-force imposed. For every one G acceleration force, a corresponding one psi air pressure is exerted in the anti-G suit.

DATA CASE.

A data case is located on the aft left side of the fuselage and is reached through an access door below and forward of the horizontal stabilizer. This compartment contains the airplane "G" file, mooring and handling kit, and spare lamp lenses.

DROP MESSAGE BAG.

Two holding clips fastened to the right side of the pilot's seat hold the drop message bag.

ARMREST.

A folding armrest (5, figure 1-5) is located on the left side of the cockpit, aft of the throttle.

RELIEF TUBE.

A pilot's relief tube is located on the cockpit floor, at the front edge of the pilot's seat.

MAP CASE.

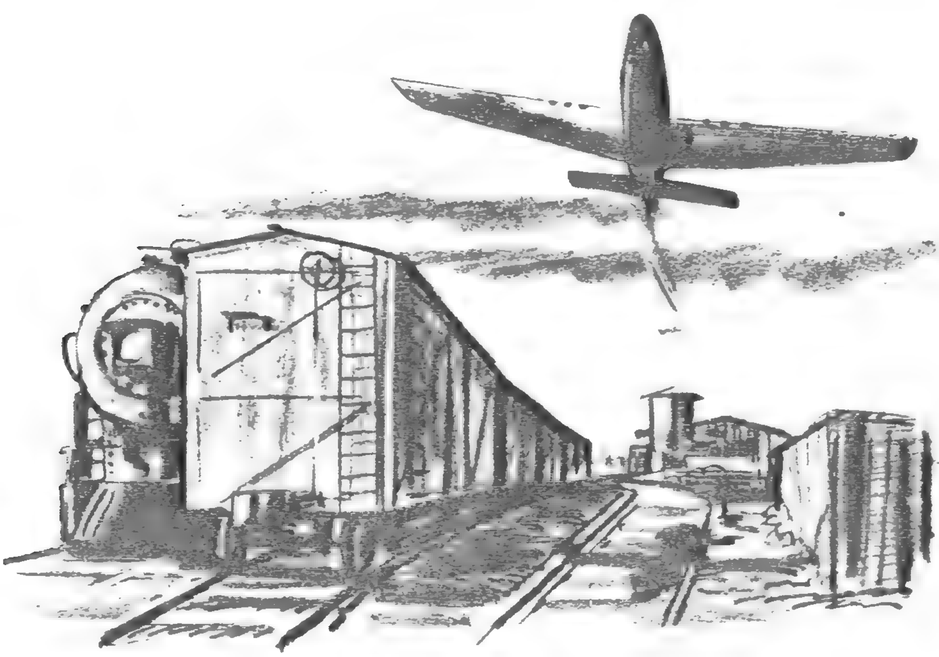
A map stowage case (10, figure 1-7) is located along the right side of the center pedestal.

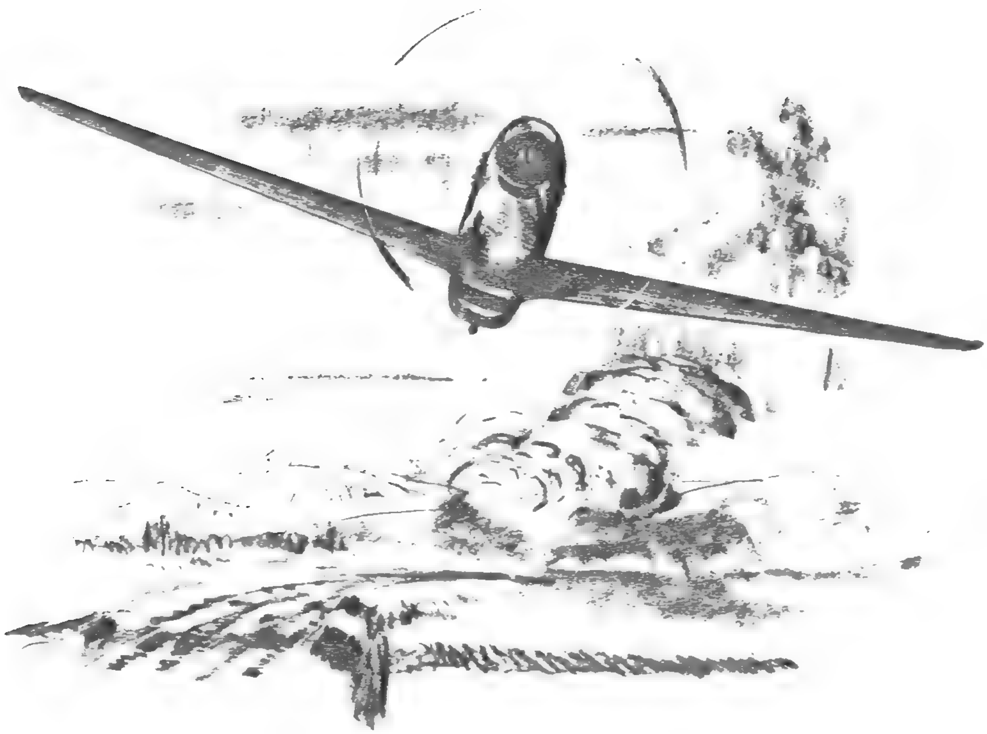
CHECK LIST.

A pilot's check list is installed on a spring-loaded hinge below the instrument panel or shroud.

AIRPLANE TIE-DOWN.

Tie-down points are provided on each wing, both main wheel axles, and the fuselage. A flush mooring ring is provided on the lower surface of each wing, approximately in line with the outboard end of the wing flap. These rings are pried out for use. A mooring ring is provided on the inboard side of each main landing gear axle. For fuselage tie-down, the tie-down rope is passed through the lift tube below and aft of the insignia.





Operating Limitations

INSTRUMENT MARKINGS.

Instrument markings showing the various operating limits are illustrated in figure 5-1. In some cases, the markings represent limitations that are self-explanatory and therefore are not discussed in the text. Operating restrictions or limitations that do not appear as maximum limits on the cockpit instruments are discussed in detail in the following paragraphs. Limitations relative to hot- and cold-weather operation, instrument flight, and flight through turbulent air are covered in Section IX.

ENGINE LIMITATIONS.

All normal engine limitations are shown in figure 5-1. The maximum diving engine overspeed is 3300 rpm. Avoid prolonged cruising at low power from 1600 to 1900 rpm, to minimize lead fouling of spark plugs. War Emergency Power may be used for 5 minutes dry or 7 minutes wet under emergency conditions. (This 7 minutes wet is based on the limit of the water supply.)

WARNING

Whenever engine speed exceeds the operating limits, the airplane should be landed immediately at the nearest base. The reason for the overspeed (if known), the maximum rpm, and the duration must be entered in the Form 1 and reported to the maintenance officer. Overspeed between 3300 and 3600 rpm necessitates an inspection of the engine before further flight. Overspeed exceeding 3600 rpm requires removal of the engine for overhaul.

AIRSPEED LIMITATIONS.

The red pointer on the airspeed indicator marks the maximum permissible airspeed of 525 mph or Mach .75, whichever is less. (See figure 6-3 for diving speed limits at high altitudes.) Do not extend landing gear above 170 mph IAS. Do not exceed the following wing flap setting airspeed restrictions:

ANGLE DOWN DEGREES	MAXIMUM IAS MPH
10	400
20	275
30	225
40	180
50	160

Do not lower landing light above 170 mph IAS. With 75- or 110-gallon drop tanks installed, do not exceed 400 mph IAS because of buffeting.

INSTRUMENT *Markings*

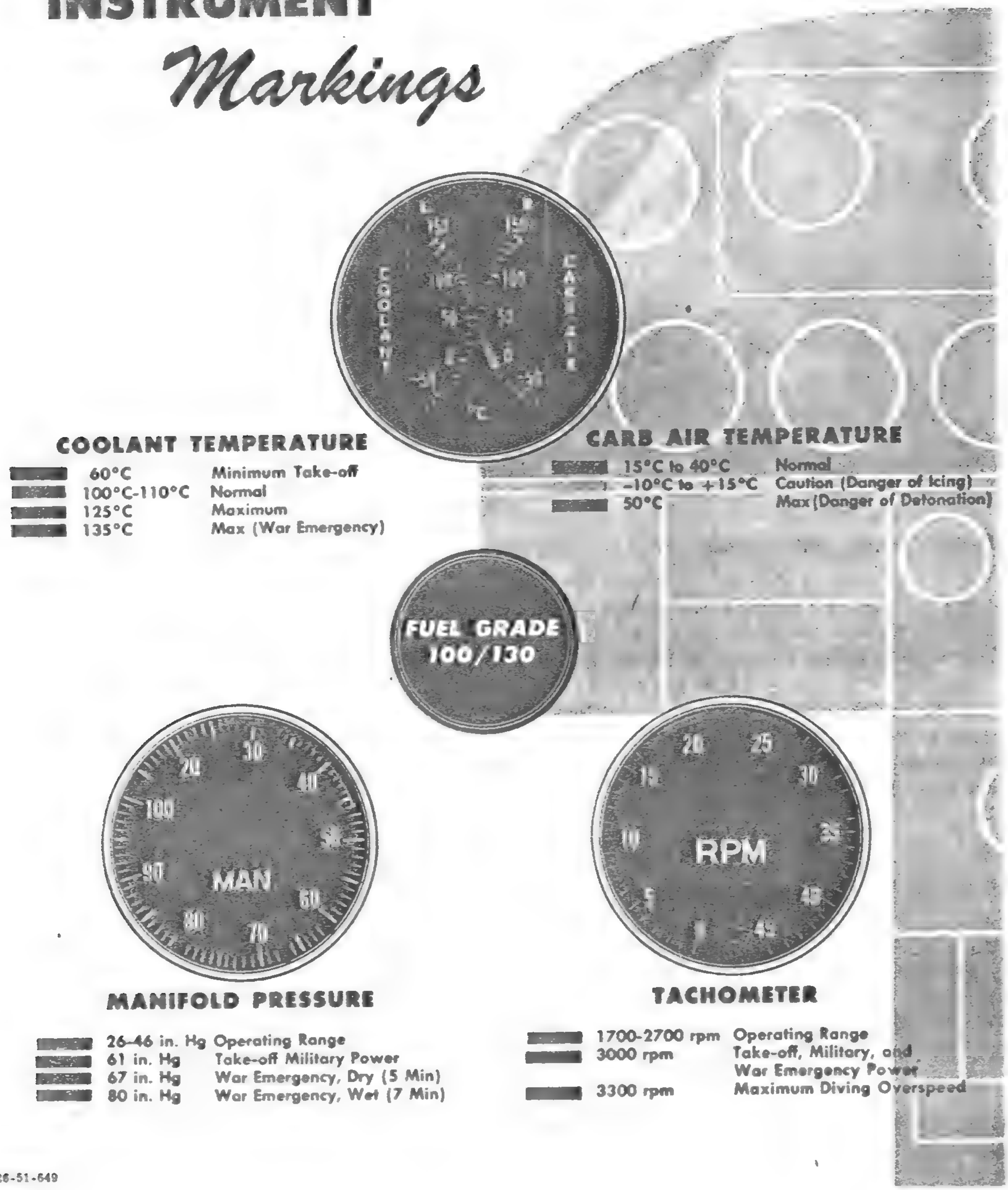


Figure 5-1 (Sheet 1 of 2)

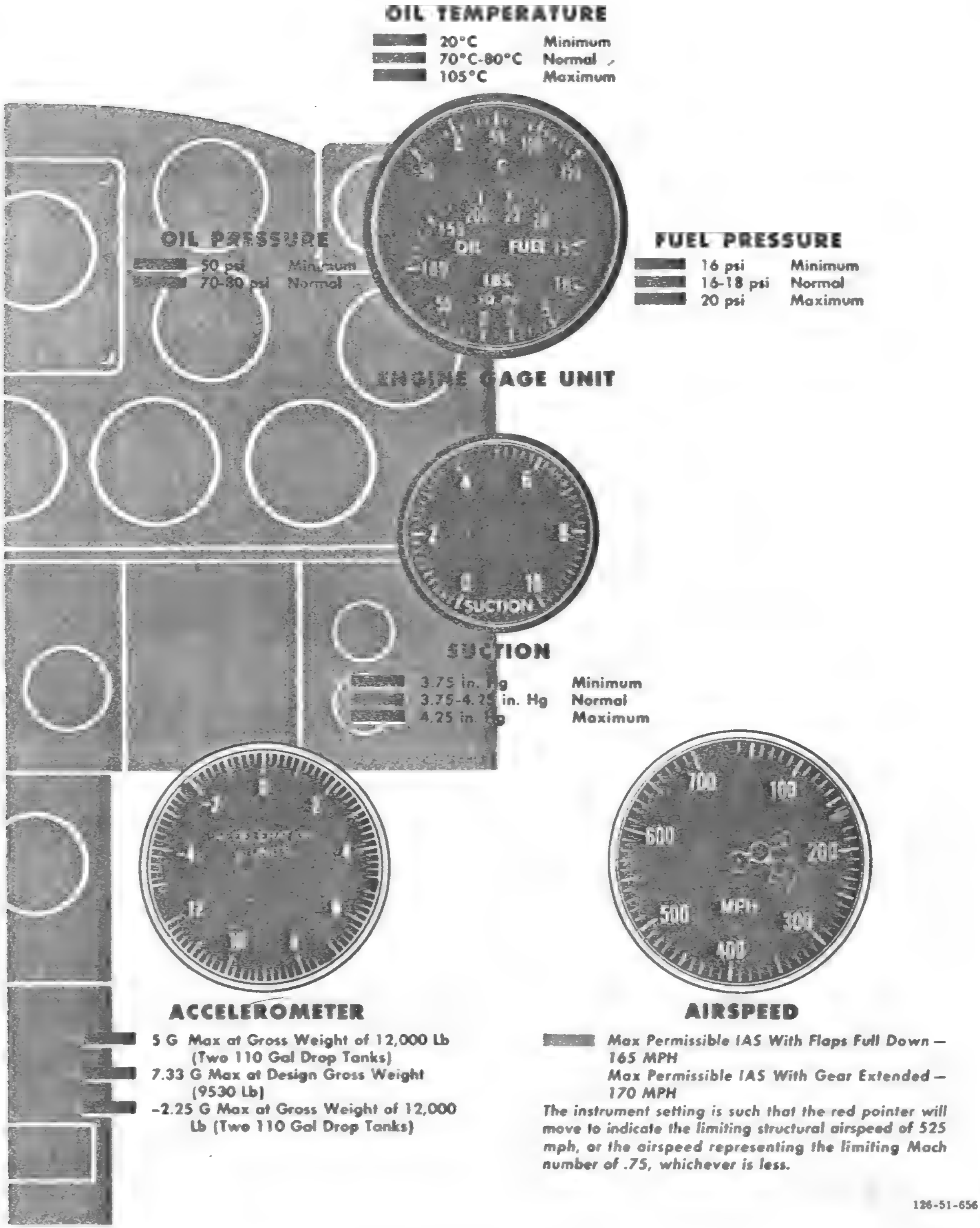


Figure 5-1 (Sheet 2 of 2)

PROHIBITED MANEUVERS.

Intentional power-on spins are prohibited. Snap rolls are prohibited. When drop tanks or bombs are installed, only normal flying attitudes are permitted. Power-off spins are permitted, provided such spins are started above 12,000 feet. Limit inverted flying to 10 seconds because of loss of oil pressure and failure of the scavenge pumps to function properly in inverted position.

ACCELERATION LIMITATIONS.

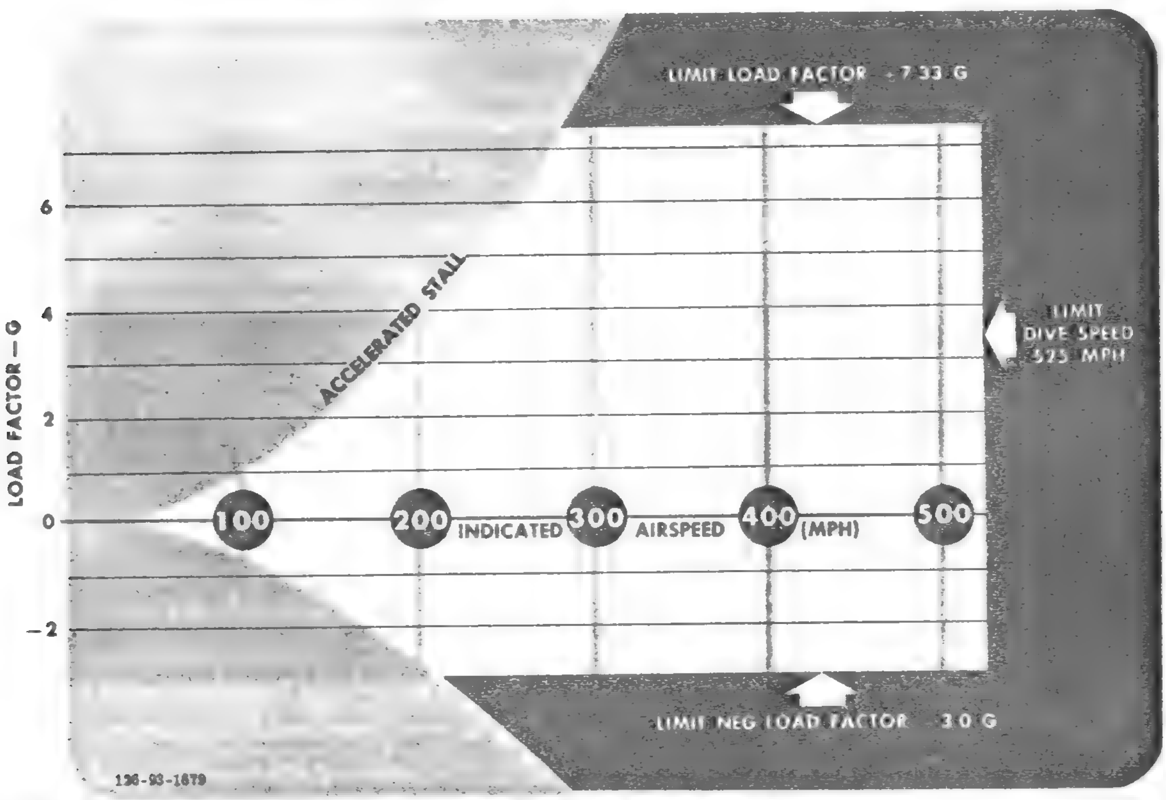
The airplane is limited to a maximum positive load factor of 7.33 G and a maximum negative load factor of −3 G. These limits apply only when the clean airplane gross weight does not exceed 9530 pounds (design gross weight). When airplane gross weight is greater than 9530 pounds, the maximum allowable G is less than the maximum limit marked on the accelerometer. Remember that when you pull the maximum G (7.33), the wings of your airplane must support 7.33 times their normal load. This means that during a maximum-G pull-out, the wings of the airplane (at design gross weight) are supporting 7.33 times 9530 pounds, or a total of approximately 69,800 pounds (maximum that the wings can safely support). Therefore, when your airplane weighs more than 9530 pounds, the maximum G that you can safely apply can be determined by dividing 69,800 by the new gross weight. When external loads are carried, the maximum allowable G-load is 5 G. The maximum load factors we have been talking about apply only to straight pull-outs. Rolling pull-outs are a different story, however, since they impose considerably more stress upon the airplane. The maximum allowable load factor in a rolling pull-out is two-thirds the maximum G for a straight pull-out.

OPERATING FLIGHT LIMITS.

The Operating Flight Limits diagram (figure 5-2) shows the G-limitations of the airplane. Various load

OPERATING *Flight Limits*

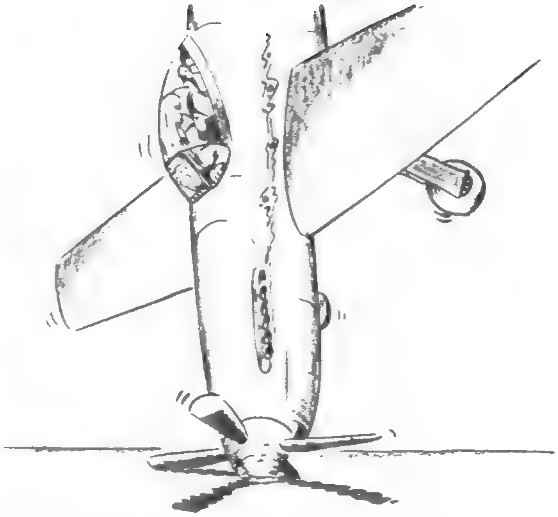
BASED ON DESIGN GROSS WEIGHT (9530 POUNDS) OR LESS



***NOTE:** To obtain new limit load factor for greater gross weights, divide 70,000 by the new gross weight.*

Figure 5-2

factors are shown vertically along the left side of the chart, and various indicated airspeeds are shown horizontally across the center of the chart. The horizontal red lines at the top and bottom of the chart represent the maximum positive and maximum negative allowable load factors. The vertical red line indicates the limit dive speed of the airplane. The curved lines show the G at which the airplane will stall at various airspeeds. The upper curved line shows, for example, that at 150 mph the airplane will stall in a 2 G turn, while at 200 mph the airplane will not stall until more than 3.6 G is applied. The upper and lower limits at the right side of the chart illustrate the maximum positive and negative limit load factors (−7.33 G and −3 G) that can be safely applied up to the limit dive speed of the airplane.

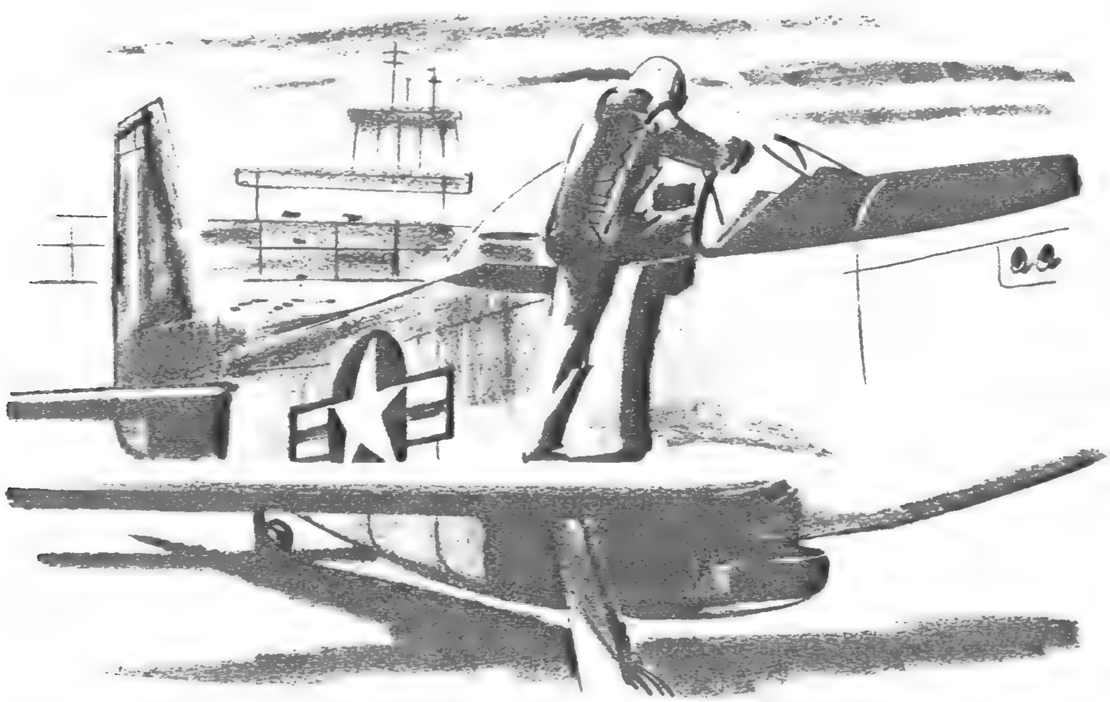


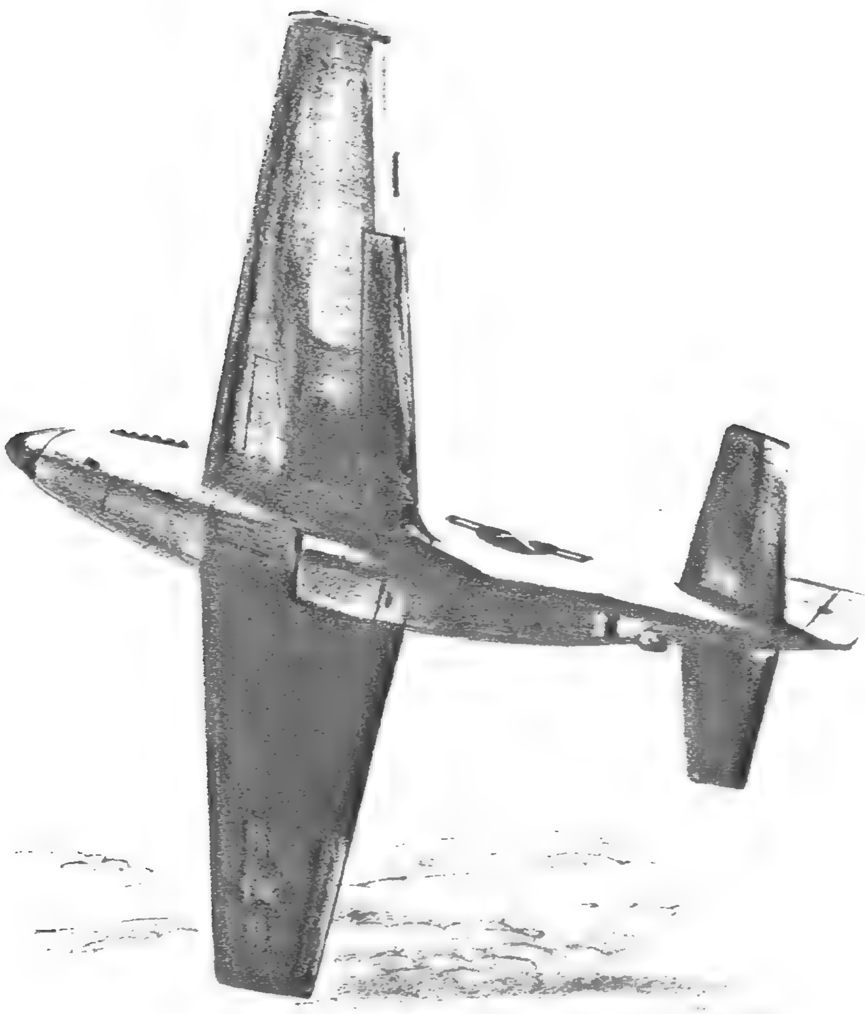
CENTER-OF-GRAVITY AND WEIGHT LIMITATIONS.

Any configuration of external load that the airplane is designed to carry may be installed without exceeding the CG limits or overloading the airplane.

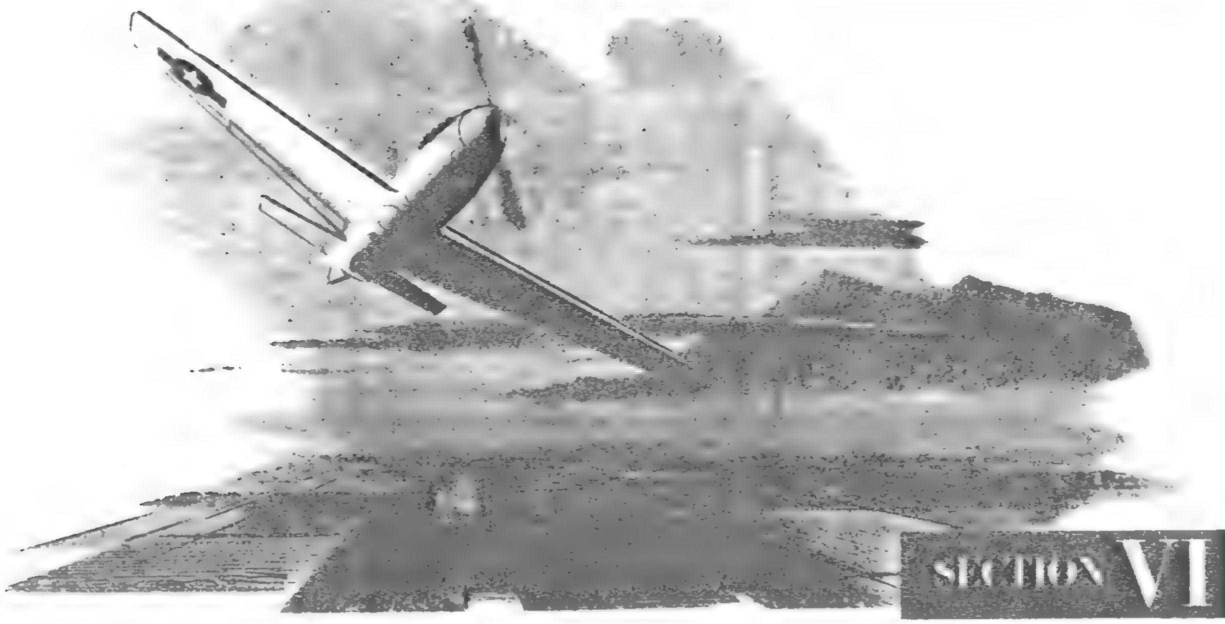
Caution

When fuselage tank is nearly empty, use caution in landing, because of a slight nose-heavy condition of the airplane.





Flight Characteristics



GENERAL.

The flying qualities of the airplane are normal, both in accelerated maneuvers and in steady flight. The trim tab characteristics are normal, but sensitive for high-speed trim conditions.

At all speeds with power, sideslips to the left require less pedal force than do sideslips to the right, but the force variation is normal. Moderate fin buffeting occurs at high angles of sideslip. The effect of flap and landing gear operation on the trim of the airplane in flight as follows:

Flaps down............................Tail-heavy
Gear down............................Nose-heavy
Gears and flaps down...........Slightly tail-heavy

STALLS.

The stall in this airplane is comparatively mild. With idling power, stall warning is given by very slight airplane buffeting 2 to 3 mph above stall speed, followed by nose-down pitching at stall. There is mild longitudinal oscillation until the stick pressure is relieved. If further back pressure is applied, the airplane rolls off on either right or left wing. This rolling condition is more severe with flaps down. Recovery from the stall is entirely normal and is accomplished by release of back pressure on the stick. In approaching the stall, some aileron or rudder deflection may be required to hold wings level. The high-speed stall is characterized by some buffeting, but no abrupt rolling is experienced. The stalling speed can vary widely with gross weight and external loads. (See figure 6-1.)

PRACTICE STALLS.

The following practice stalls will acquaint you with the stall traits and stall speeds of the airplane under various flight conditions. For both power-on and power-off stalls, set the propeller control to obtain 2700 rpm. Retard throttle smoothly to 10-12 in. Hg for power-off stalls; set throttle for 30 in. Hg for power-on stalls.

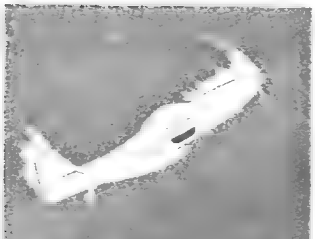
PRACTICE STALL – GEAR AND FLAPS DOWN, POWER OFF, STRAIGHT AHEAD.

1. Close throttle.
2. Gear down at 170 mph.
3. Lower full flaps at 160 mph.
4. Establish 130 mph glide and raise nose to landing attitude.
5. Hold this attitude until stall breaks; observe characteristics of airplane in stall (usually left wing stalls before right). After nose drops, initiate stall recovery by smoothly advancing throttle to 45 in. Hg and ease stick forward to regain flying speed.

Stall Speeds

IAS • MPH (POWER OFF)

BASED ON FLIGHT TESTS



WITH WING RACKS

GROSS WEIGHT LB	GEAR UP FLAPS UP			GEAR DOWN FLAPS 45° DOWN		
	LEVEL	30° BANK	45° BANK	LEVEL	30° BANK	45° BANK
10,000	117	125	139	105	114	126
9,000	111	119	132	100	108	119
8,000	104	112	124	94	101	112

WITH BOMBS, DROP TANKS, OR ROCKETS*

GROSS WEIGHT LB	GEAR UP FLAPS UP			GEAR DOWN FLAPS 45° DOWN		
	LEVEL	30° BANK	45° BANK	LEVEL	30° BANK	45° BANK
13,000	135	145	160	122	131	146
12,000	130	139	154	117	126	140
11,000	124	133	148	112	120	134
10,000	118	127	141	106	114	127
9,000	112	121	133	100	108	121

*STALL SPEEDS WITH ROCKETS ARE ESTIMATED.

125-93-1731

Figure 6-1

6. Level wings with rudder and aileron and regain 130 mph; then retard throttle to 30 in. Hg.

7. Raise gear and flaps.

PRACTICE STALL – GEAR AND FLAPS DOWN, POWER-OFF, MEDIUM BANK.

1. Close throttle.

2. Gear down at 170 mph.

3. Lower full flaps at 160 mph.

4. Establish 130 mph glide.

5. Enter a medium bank, right or left; slow airplane and tighten turn with elevator until stall breaks.

6. As stall breaks, recover with stick forward, and advance throttle smoothly to 45 in. Hg.

7. Roll wings level with rudder and aileron as soon as possible.

8. Raise gear and flaps; return to cruising power.

PRACTICE STALL – GEAR AND FLAPS UP, POWER ON, STRAIGHT AHEAD OR IN TURN.

1. Cruise throttle setting.

2. Raise nose to about a 40-degree climb attitude straight ahead, or use a gentle climbing turn right or left and tighten turn with back pressure until stall breaks.

3. As stall breaks, effect normal recovery, smoothly advancing throttle to 45 in. Hg.

4. Retard throttle to cruise power after recovery.

SPINS.

POWER-OFF SPINS.

The airplane does not have any spin tendency at the stall, and it is necessary to force the airplane into the

spin. (See figure 6-2.) In general, spins in this airplane are uncomfortable because of heavy oscillations and rolling. These motions are not regular, but occur erratically during the spin. Normally, the airplane goes over to a slightly inverted position in the first half turn of the spin. Spins to the left with gear and flaps up are fairly slow and approach a nearly stabilized condition after approximately three turns. The airplane spins to the left at an angle of approximately 45 degrees below the horizontal. The rate of spin rapidly increases momentarily as control is applied for recovery, and then stops abruptly. The right spin with gear and flaps up is erratic, with the nose of the airplane coming up to the horizontal and then dropping with a sudden lateral oscillation accompanied by a very rapid increase in rate of spin. During the spin, it feels as though the airplane is partially recovering before it whips off again. Although the spin does not stabilize, the recovery characteristics are excellent. The spin is always more rapid and erratic to the right than to the left. With the gear extended, the spin is erratic both to the left and right, with the same lateral and longitudinal oscillations noted with the gear retracted in *right spins*. During recovery from the right spin (gear extended), a slight buffet may be noted; this buffet is eliminated as soon as the airspeed is increased.

POWER-OFF SPIN RECOVERY.

Make normal recovery from either right or left spin as follows:

1. Controls with spin, ailerons neutral.
2. Apply full opposite rudder. (Nose will drop slightly and spin will speed up rapidly for about 1¼ turns and then stop.)
3. Stick neutral after airplane responds to rudder (as rotation stops).
4. Rudder to neutral and complete recovery as spin ends.

The rudder and elevator forces are normal, with no excessive loads during recovery. Recovery from spins may be effected within one-fourth to one turn. Approximately 6500 to 7000 feet altitude is lost during a five-turn spin plus a one-turn recovery.

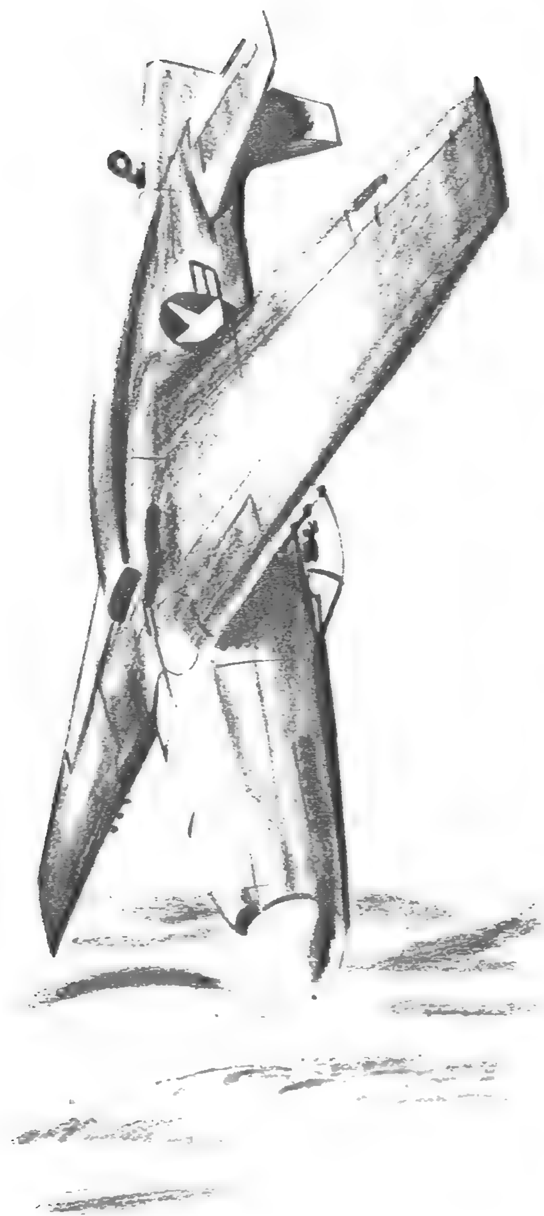
Note

> During the spin, a slight rudder buffeting is noticeable. If you attempt to recover from the dive too soon after the spin stops, you will also feel a rather heavy buffeting in both the elevator and rudder. The remedy for this condition is to release some of the back pressure on the stick.

POWER-ON SPINS.

Power-on spins should not be intentionally performed in this airplane. However, if a power-on spin is

Figure 6-2



accidentally entered, immediately close throttle and apply controls as for power-off spin recovery. As many as five or six turns are made after rudder is applied for recovery, and 9000 to 10,000 feet of altitude is lost.

CAUTION

Extreme loss of altitude is to be anticipated in a power-on spin.

FLIGHT CONTROL EFFECTIVENESS.

AILERON CONTROL.

Control stick pressure for aileron control is considered desirably light and gives a positive roll control to the airplane. The sealed-balance ailerons have a fabric diaphragm that seals the space between the leading edge of the aileron and the aft side of the rear wing spar and tends to lighten the control stick forces.

HORIZONTAL TAIL CONTROL.

At normal cruise speeds, elevator control is good and stick pressure is light.

RUDDER CONTROL.

Because of reverse-boost rudder tab and dorsal fin, the airplane has very good directional stability, with a directional change requiring definite pressure of the rudder pedal in proportion to the amount of yaw desired. Rudder pedal pressures are very high pulling out of a dive. With power, sideslips to the left require less pedal force than sideslips to the right. You will encounter moderate fin buffeting at high angles of sideslip.

TRIM TAB CONTROL.

Trim tabs are very sensitive and should be used with care at high speed.

LEVEL-FLIGHT CHARACTERISTICS.

LEVEL-FLIGHT STABILITY.

Level-flight stability is very good, with light stick forces at all speeds.

MANEUVERING FLIGHT.

MANEUVERING-FLIGHT STABILITY.

Maneuverability is very good. However, use care not to exceed maximum allowable G-limits because of the lightness of control pressures. Do not attempt any abrupt maneuvers with external loads. There are no control pressure reversals except during a maximum-speed dive, when controls will tend to lighten as red-line speed is reached. (Refer to "Maximum Diving Speeds" in this section.) The reverse-boost rudder tab gives the desired effect that an increase in rudder pedal pressure is always necessary to obtain an increase in yaw angle.

DIVES.

MAXIMUM DIVING SPEEDS.

At high diving speeds, there is danger of the airplane being affected by compressibility, a phenomenon likely to be encountered when true airspeed approaches the speed of sound. Compressibility may be indicated by instability of the airplane, rolling or pitching, lightening or reversing of control forces, or combinations of these effects. However, the airplane feels steady up to the limit Mach number of present tests, .75 (75 percent of the speed of sound), and no porpoising or wallowing is experienced. Some buffeting may be expected above a Mach number of .75, and increased aileron control pressure may be necessary to hold wings level.

Attention should be paid to the elevator stick force variation during high-speed dives. In high-speed dives at high altitudes, it will be noted that stick forces increase during the first part of the dive, then lighten as the speed is increased, and finally may reverse, requiring light pull force to maintain a constant G. The elevator force variation is a compressibility effect, with forces first lightening at .72 Mach number and possibly reversing at some higher Mach number. If a speed requiring a pull force is reached before pull-out, then during pull-out, maintaining a constant G, a change from the pull force to a push force should be anticipated as the speed is decreased.

It is recommended that a tab setting corresponding to trim in level flight with normal cruise power (or very slightly tail-heavy trim) be used for high-speed dives, and that the tab setting not be changed during dive and recovery. However, the power setting may be advanced if desired, provided it is not necessary to decrease power during dive or pull-out.

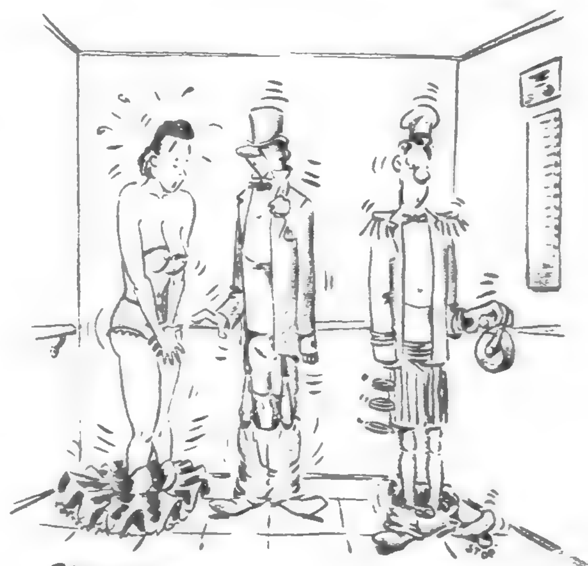
Rudder pedal forces increase normally during dives, but do not become excessive.

ALTITUDE REQUIRED FOR PULL-OUT.

Figure 6-3 shows the altitude required for pull-out from dives for a constant 4 G or 6 G acceleration. The anti-G suit should be used before a 6 G pull-out is attempted.

DIVE RECOVERY.

If the diving limits shown on figure 6-3 are exceeded inadvertently and pronounced compressibility effects (buffeting) are experienced, pull up very gradually.



Warning

Care should be taken in pull-outs, since the stick forces are relatively light, and abrupt pull-outs should be avoided.

FLIGHT WITH EXTERNAL LOADS.

DROP TANKS.

At high speeds (in excess of 400 mph) with 75-gallon combat fuel tanks installed, buffeting will be encountered. With drop tanks installed, either empty or full, airplane tends to be nose-heavy on take-off run. Use at least 5-degree tail-heavy trim for take-off.

IN DIVE RECOVERY

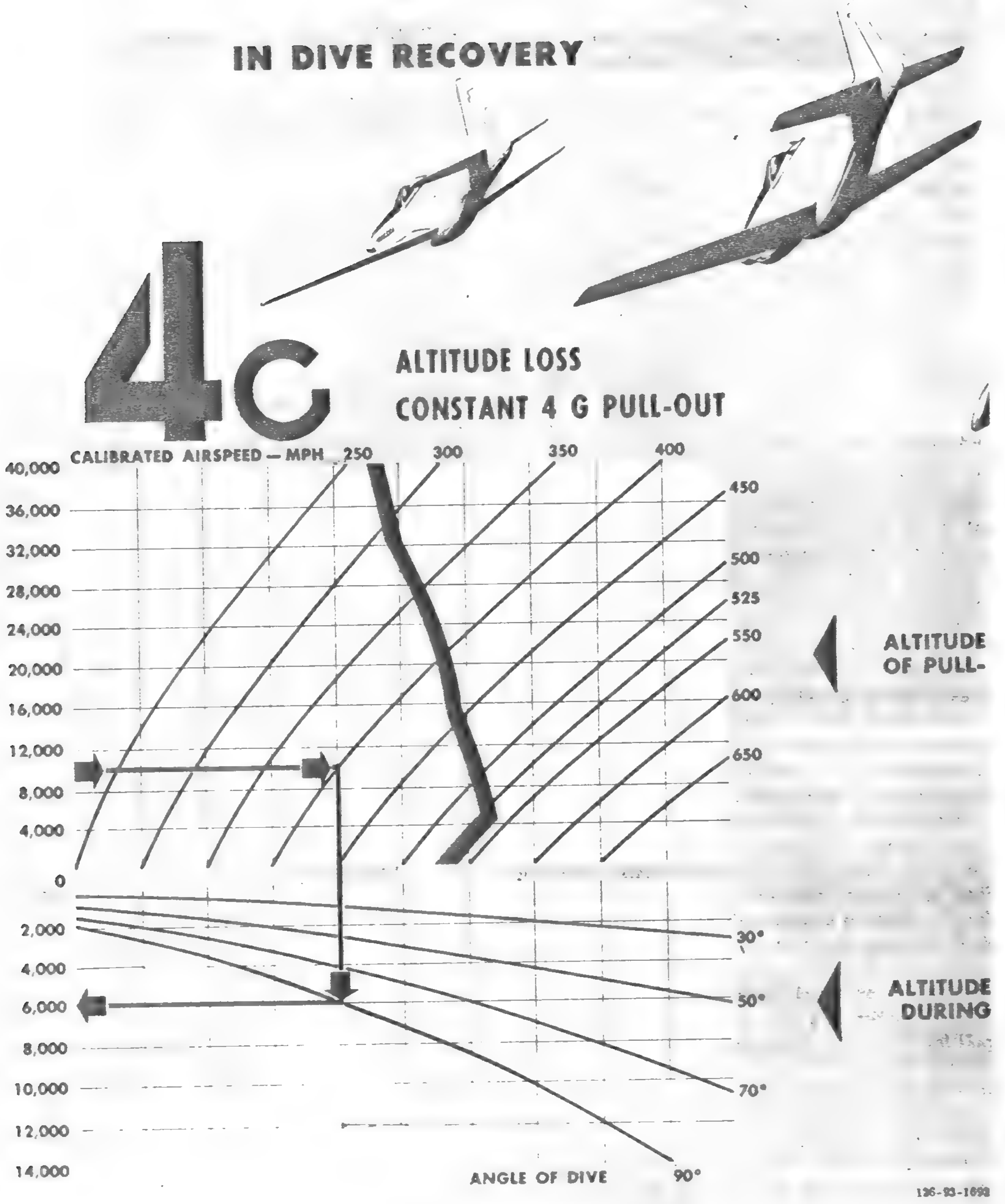
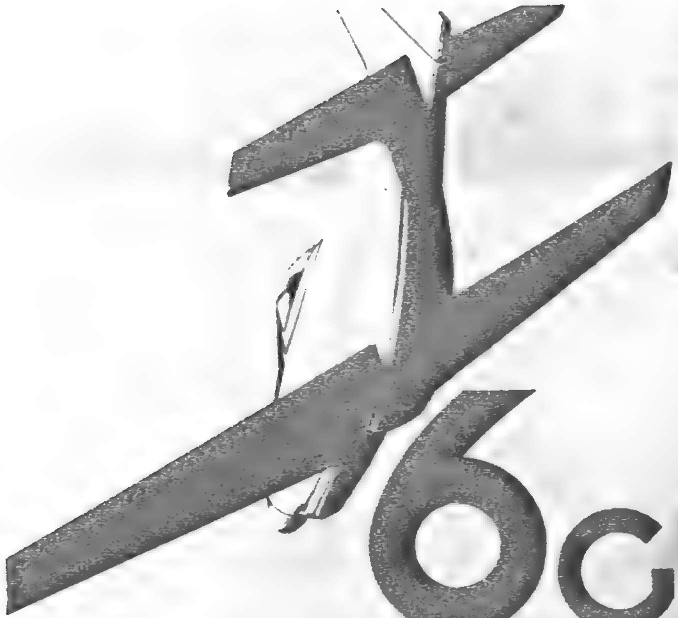


Figure 6-3 (Sheet 1 of 2)



HOW TO USE CHARTS

Select appropriate chart depending upon acceleration (4 G or 6 G) to be held in pull-out; then—

- Enter chart at altitude line nearest actual altitude at start of pull-out (for example, 10,000 feet).
- On scale along altitude line, select point nearest the CAS at which pull-out is started (400 mph).
- Sight vertically down to point on curve of dive angle (90°) directly below airspeed.
- Sight back horizontally to scale at left to read altitude lost during pull-out (constant 4 G pull-out, 6000 feet; constant 6 G pull-out, 4000 feet).

ALTITUDE LOSS
CONSTANT 6 G PULL-OUT

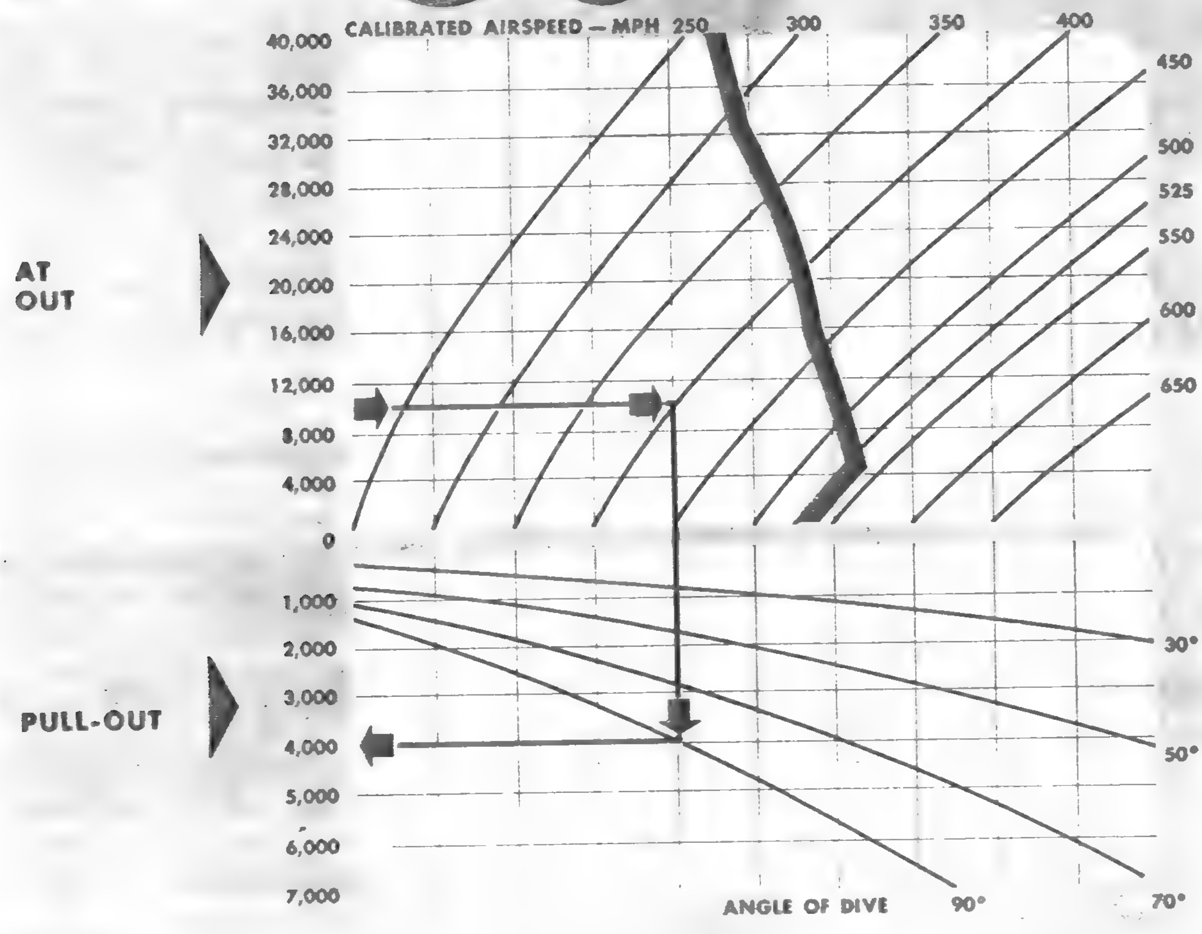
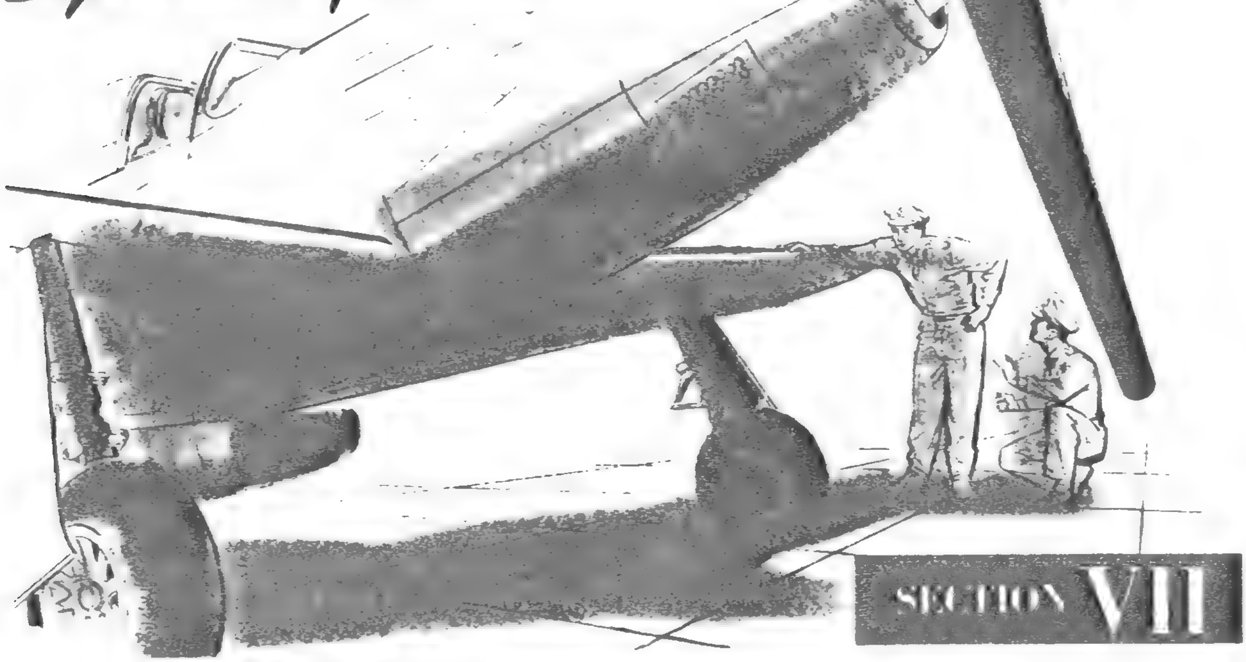


Figure 6-3 (Sheet 2 of 2)

Systems Operation



ENGINE.

USE OF TAKE-OFF (MILITARY) POWER.

It is often asked what the consequences will be if the 5-minute limit at Take-off Power is exceeded. Another frequent inquiry is how long a period must be allowed after the specified time limit has elapsed until Take-off Power can again be used. These questions are difficult to answer, since the time limit specified does not mean that engine damage will occur if the limit is exceeded, but means that total operating time at high power must be kept to a reasonable minimum in the interest of prolonging engine life. It is generally accepted that high-power operation of an engine results in increased wear and necessitates more frequent overhaul than low-power operation. However, it is apparent that a certain percentage of operating time must be at full power. The engine manufacturer allows for this in qualification tests in which much of the running is done at Take-off Power to prove ability to withstand the resulting loads. It is established in these runs that the engine will handle sustained high power without damage. Nevertheless, it is still the aim of the manufacturer and to the best interest of the pilot to keep within reasonable values the amount of high-power time accumulated in the field. The most satisfactory method for accomplishing this is to establish time limits that will keep pilots constantly aware of the desire to keep high-power periods as short as the flight plan will allow, so that the total accumulated time and resulting wear can be kept to a minimum. How the time at high power is accumulated is of secondary importance; i. e., it is no worse from the standpoint of engine wear to operate at Take-off Power for one hour straight than it is to operate in twelve 5-minute stretches, provided engine temperatures and pressures are within limits. In fact, the former procedure may even be preferable, as it eliminates temperature cycles which also promote engine wear. Thus, if flight conditions occasionally require exceeding time limits, this should not cause concern so long as constant effort is made to ***keep the over-all time at Take-off Power to the minimum practicable.*** Another factor to be remembered in operating engines at high power is that full Take-off Power (3000 rpm and 61 in. Hg) is to be preferred over take-off rpm with reduced manifold pressure. This procedure results in less engine wear for two reasons. First, the higher resulting brake horsepower decreases the time required to obtain the objective of such high-power operation. At take-off, for example, the use of full power decreases the time required to reach an altitude and airspeed where it is safe to reduce power and shortens the time required to reach the airspeed that will provide more favorable cooling. Second, high rpm results in high loads on the reciprocating parts due to inertia forces. As these loads are partially

offset by the gas pressure in the cylinder, the higher cylinder pressures resulting from use of full take-off manifold pressure give lower net loads and less wear. Sustained high rpm is a major cause of engine wear. It requires more "rpm minutes" and "piston-ring miles" to take off with reduced manifold pressure. In addition to the engine wear factor, taking off at reduced power is comparable to starting with approximately one-third of the runway behind the airplane. Therefore, full power should *always* be used on take-offs.

WAR EMERGENCY POWER.

During emergencies in a combat zone, it is sometimes necessary to get the absolute maximum manifold pressure at which the engine may be operated within reasonable safety limits. This extra power is available when the throttle is pushed beyond a gate on the throttle quadrant, provided the following requirements are fulfilled:

Note

Entry must be made on Form 1 of length of time of War Emergency power operation (which is limited to a maximum period of 5 minutes dry or 7 minutes using water injection).

1. Airplane must be placarded with a decal stating that use of War Emergency Power is permitted.

2. Fuel Grade 100/130 must be used, and a special type of spark plugs must be installed.

Note

For War Emergency Power operation with water injection, spark plug barrels and spark plug cable connectors must be packed with Dow-Corning sealing compound No. 4, and a steel or brass washer must be inserted between the resistor and the spring retainer of the spark plug cable connector.

CAUTION

If the oil has been diluted, it is desirable to operate the engine 10 or 15 minutes at between 80 percent Normal Power and Military Power before using War Emergency Power, to remove excess fuel from oil.

WARNING

The following precaution is applicable to War Emergency Power wet operation of late airplanes* only. On other airplanes, the water pump will not restart if the water supply is depleted. After the water supply is exhausted, as indicated by automatic resetting of manifold pressure to the maximum dry rating, move water injection switch to OFF. If the switch is left ON and the throttle is retarded and again advanced, a momentary surge of manifold pressure above the allowable dry limit will occur, with possible damage to the power plant when no water is available.

SPARK PLUG FOULING.

Prolonged cruising operation at low power settings tends to cause spark plug fouling. This fouling causes engine roughness. To determine whether the plugs are at fault, clean out engine by advancing propeller control to 3000 rpm and throttle to 61 in. Hg and run engine at this power setting continuously for one minute. Return throttle and propeller control to cruise setting and notice whether engine roughness persists. If roughness is still present, check for carburetor ice; then, if engine is still rough, reduce power to best operating setting and proceed to nearest base for landing. During prolonged cruising flight, clean out engine every 30 minutes continuously for one minute with the afore-mentioned procedure. Also clean out engine before landing.

SUPERCHARGER SURGE.

Because of the design of the supercharger in the V-1650-9 engine, the supercharger is subject to surging in both high and low blower at various rpm, manifold pressure, and altitude combinations. Supercharger surging causes a fluctuation in manifold pressure and induces erratic fuel metering. Under severe surging conditions, the engine cuts out completely. When surging is encountered, it may be corrected by either increasing the rpm setting or by decreasing the manifold pressure setting. Figure 7-1 shows the lowest power settings (in terms of engine rpm and manifold pressure) where surging can be expected at various altitudes.

CARBURETOR ICING.

Carburetor ice forms more readily when carburetor air temperature is between -10°C and -15°C. However, carburetor ice can form any time, even with outside temperature as high as 32°C (90°F) and with temperature and dew point spread as much as 12°C (22°F).

***F-51H-10 Airplane AF44-64688 and subsequent airplanes**

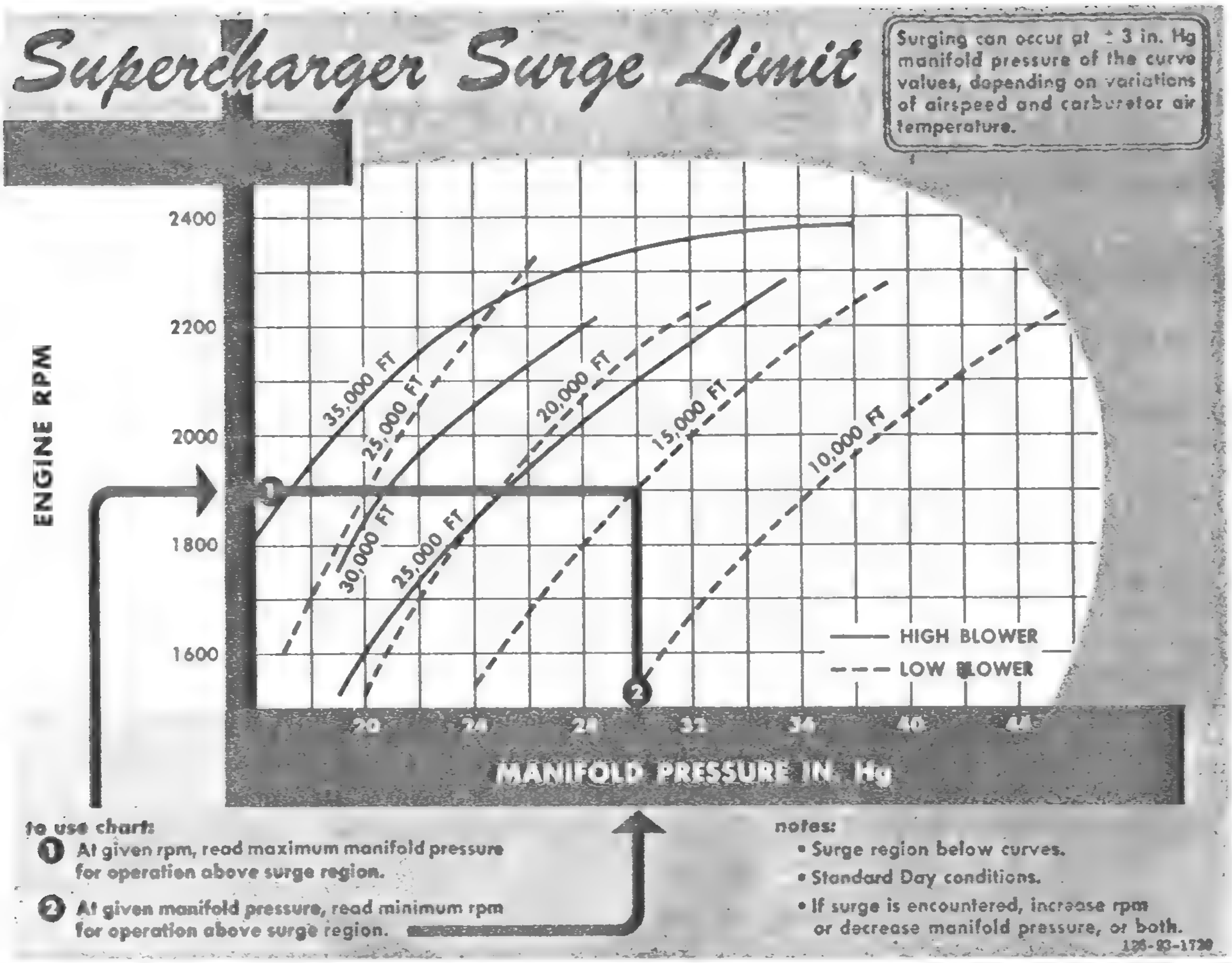


Figure 7-1

The formation of carburetor ice is hard to detect, since the Simmonds boost control unit maintains a constant manifold pressure. The only warning of carburetor ice is a roughness in the engine. If application of carburetor hot air does not remove roughness, clean out engine as directed under "Spark Plug Fouling" in this section. If roughness is caused by carburetor ice, use hot air as necessary to prevent further carburetor ice. If the air inlet duct becomes clogged with ice, hot air is automatically admitted to the air duct regardless of the position of the carburetor air control lever. However, if carburetor ice forms, hot air will not be admitted automatically.

DETONATION.

Detonation is the result of one type of abnormal combustion of the fuel-air mixture. The other prevalent form of abnormal combustion is preignition. When detonation occurs, combustion is normal until approximately 80 percent of the charge is burning. At that point, the rate of combustion speeds up tremendously and an explosion or nearly instantaneous combustion results. This explosion actually pounds the cylinder walls, producing knock. This knock, or pounding of the cylinder walls, can cause an engine failure. In an airplane, the knock is not heard because of other engine and propeller noises. However, detonation can be detected by observing the exhaust for visible puffs of black smoke, glowing carbon particles, or a small, sharp, whitish-orange flame. In addition, a rapid increase in coolant temperatures often indicates detonation. When detonation is evident, throttle reduction is the most immediate and surest remedy. *When detonation occurs, power is lost.* Contributing causes of detonation are as follows:

1. Low-octane fuel.

2. High coolant temperature caused by too long a climb at too low an airspeed or by too lean a mixture.

3. High mixture temperature caused by use of carburetor heat or by high outside air temperature.

4. Too high a manifold pressure with other conditions favorable to detonation.

5. Improper mixture caused by faulty carburetor or too lean a mixture.

PREIGNITION.

Preignition is closely related to detonation. In fact, detonation often progresses into preignition. When the engine gets too hot, the mixture is ignited before the spark occurs. When this happens, much of the power is wasted trying to push the piston down while it is still rising in the cylinder. The power impulses are uneven, horsepower falls off, and the engine can be damaged from excessive pressures and temperatures. Preignition may be indicated by backfiring through the carburetor and possibly by a rapid increase in coolant temperatures. When preignition is encountered, the throttle setting should be reduced immediately, as in severe cases, complete piston, valve, and/or cylinder destruction can occur in a matter of a few seconds.

FUEL SYSTEM.

FUEL TANK SEQUENCE.

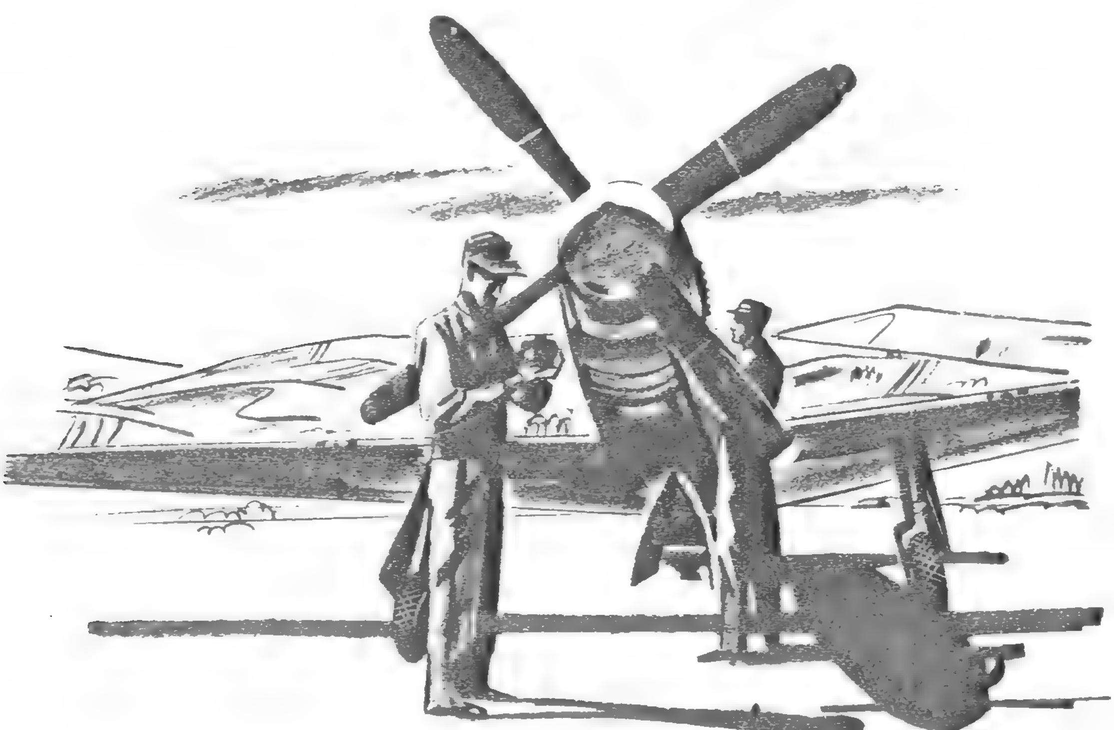
1. Take off and climb with fuel tank selector handle at MAIN WING TANKS.
2. Use drop tanks until they are empty.
3. Use main wing tanks until they are empty.
4. Switch to fuselage tank.

CAUTION

Keep fuel booster pump in operation at all times during flight to ensure adequate fuel pressure.

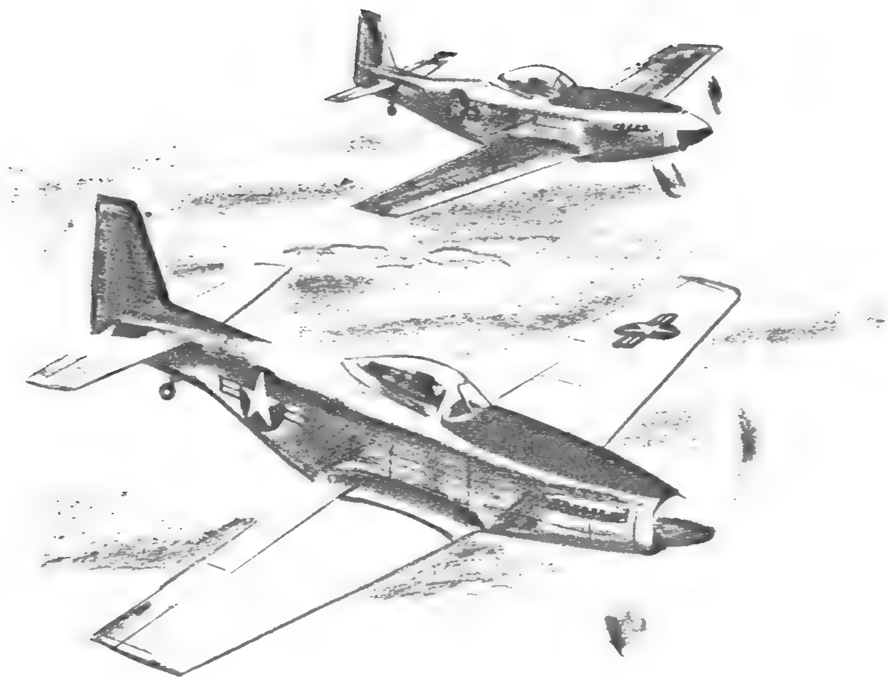
WARNING

Check operation of all fuel tanks before taxiing out instead of immediately before take-off. Taxi out on tank that will be used for take-off, to avoid possibility of air locks developing.



Crew Duties

Not applicable to this airplane.



All-Weather Operation

ALL-WEATHER OPERATION

Except for some repetition necessary for emphasis or continuity of thought, this section contains only those procedures that differ from, or are in addition to, the normal operating instructions contained in Section II.

INSTRUMENT FLIGHT PROCEDURES

Flying the airplane in all weather conditions requires proper instrument proficiency on the part of the pilot and thorough preflight planning. All the necessary flight instruments are provided, including directional gyro and flight indicator. Radio equipment includes the AN/ARC-3 command set, BC-453-B range receiver, AN/ARN-7 radio compass, SCR-695-A IFF set, and AN/APS-13 tail-warning radar.

Note

All turns are single-needle-width standard rate (3 degrees per second) 2-minute turns.

BEFORE TAKE-OFF.

Complete all checks required for any normal flight, with the following additions:

1. Check to be sure you have LF-MS edition (Radio Facilities Charts), AN 08-15-2 (USAF Radio Data and Flight Information), and T. O. No. 1F-51H-1 (Flight Handbook, formerly AN 01-60JF-1).

2. Check clock for operation and set it to correct time.

3. Check suction gage for proper indication.

4. Check that pitot head cover has been removed.

Turn pitot heater switch ON and have outside observer verify its operation. Then turn pitot heater switch OFF until airplane is in the air, as there is insufficient cooling for pitot head while airplane is on the ground.

5. Check airspeed needle at zero. Check airspeed correction card for any deviation at speed range to be flown.

6. The directional gyro requires 5 minutes for rotor to attain proper operating speed. The dial card should revolve with the knob when the gyro is caged, but not when the gyro is uncaged. Set directional gyro so that it corresponds to reading of magnetic compass.

7. The gyro horizon requires 5 minutes for rotor to attain proper operating speed. Cage instrument and uncage it. After the instrument is uncaged, the horizon

bar should return to the correct position for the airplane in a three-point attitude. Temporary vibration of the horizon bar is permissible.

Note

If the horizon bar temporarily leaves the horizontal position while the airplane is being taxied straight ahead, or if the bar tips more than 5 degrees during taxiing turns, the instrument is not operating properly.

8. Obtain station altimeter setting (field barometric pressure) from control tower operation. When the altimeter is set, the pointers should indicate the local field elevation. If the altimeter registers within 75 feet of this elevation, it may be used, provided error is properly considered when the instrument is reset during flight.

9. Check operation of turn-and-bank indicator by observing proper response of needle and ball when turns are made during taxiing.

10. Check rate-of-climb indicator needle at zero.

Note

If rate-of-climb needle does not indicate zero, tap instrument panel. If needle still indicates incorrectly, readjust it by use of screw in lower left corner of instrument.

11. Check accuracy of magnetic compass by comparing its reading to published runway heading.

12. Check carburetor air control lever set at COLD AIR RAMMED.

13. Check instruments for readings within proper ranges.

14. Check operation of all radio equipment. Adjust tuning of required radio equipment as desired.

INSTRUMENT TAKE-OFF.

Preparation, power settings, and take-off and climb speeds are identical to those used in normal take-off. Use flaps as necessary for best obstacle clearance, about 15 to 20 degrees down.

1. When cleared for take-off, taxi to center of runway and align airplane as nearly as possible straight down centerline of runway. Hold airplane with brakes and set directional gyro to published runway heading.

2. When ready, advance throttle smoothly and steadily to Take-off Power as quickly as possible and still maintain directional control against torque.

3. Do not attempt to lift tail too soon, as this increases torque action. Pushing the stick forward unlocks the tail wheel, thereby making steering difficult. The best take-off procedure is to hold the tail down until sufficient speed is attained for rudder control, and then to raise the tail slowly.

4. Maintain directional control by reference to directional gyro. Take off as airplane reaches normal VFR take-off airspeed.

TAKE-OFF SPEEDS

10,000 lb (no external load)	106 mph IAS
11,000 lb (external load)	111 mph IAS
12,000 lb (external load)	116 mph IAS

5. Raise gear as soon as altimeter and rate-of-climb indicator begin to register a climb.

6. Establish a normal climb.

7. Raise flaps when sufficient airspeed is attained and all obstacles are cleared.

8. Reduce power and propeller settings to normal climb settings.

INSTRUMENT CLIMB.

1. Trim airplane at normal climbing speed.

2. Leave traffic and climb to assigned altitude. Do not exceed 30-degree angle of bank during climbing turns.

INSTRUMENT CRUISING FLIGHT.

No departure from normal cruise procedures is necessary. Refer to Flight Operation Instruction Chart for desired cruise. Adjust trim with caution so as not to overtrim. Use aileron trim tabs to maintain lateral trim for any unequal fuel distribution in main fuel cells. If flaps or landing gear are extended, adjust power setting and trim accordingly.

Note

To ensure the lowest fuel consumption on a long-range mission, the highest manifold pressure consistent with the Flight Operation Instruction Charts should be used with any given rpm setting. However, to minimize spark plug fouling due to prolonged cruising at low power (especially in the range from 1600 to 1900 rpm), high power (3000 rpm and 61 in. Hg) should be used continuously for one minute every 30 minutes when the fuel supply is adequate.

DESCENT.

Follow normal descent procedures. Limit angle of bank to 30 degrees and single-needle-width turns.

CAUTION

Turn on defroster 10 or 15 minutes before descent, to avoid fogging of canopy or windshield.

HOLDING.

For holding operations with minimum fuel consumption, refer to note at end of "Instrument Cruising Flight" in this section. Also refer to Maximum Endurance Chart (figure A-10) for power settings at altitude where holding operation is being accomplished.

INSTRUMENT APPROACH.

Use standard radio range letdown and low-visibility approaches. (See figure 9-1.)

GROUND-CONTROLLED APPROACH (GCA).

For landing under instrument conditions by use of directions from GCA radar equipment after letdown on a radio range (figure 9-2), proceed as follows:

1. Establish contact with GCA over GCA pickup point.
2. Hold 140 mph IAS until final turn is completed, running through GCA prelanding cockpit check as instructed by GCA controller.
3. After completing turn to final approach and before intercepting glide path, lower flaps 15 degrees to give a steeper approach if desired.
4. As glide path is intercepted, reduce power settings to establish 130 mph glide, and descend as directed by GCA final controller, using throttle as necessary.

MISSED-APPROACH GO-AROUND.

In case of missed approach, follow this procedure for go-around:

1. Open throttle smoothly to 45 in. Hg.
2. Maintain wings level, nose straight.

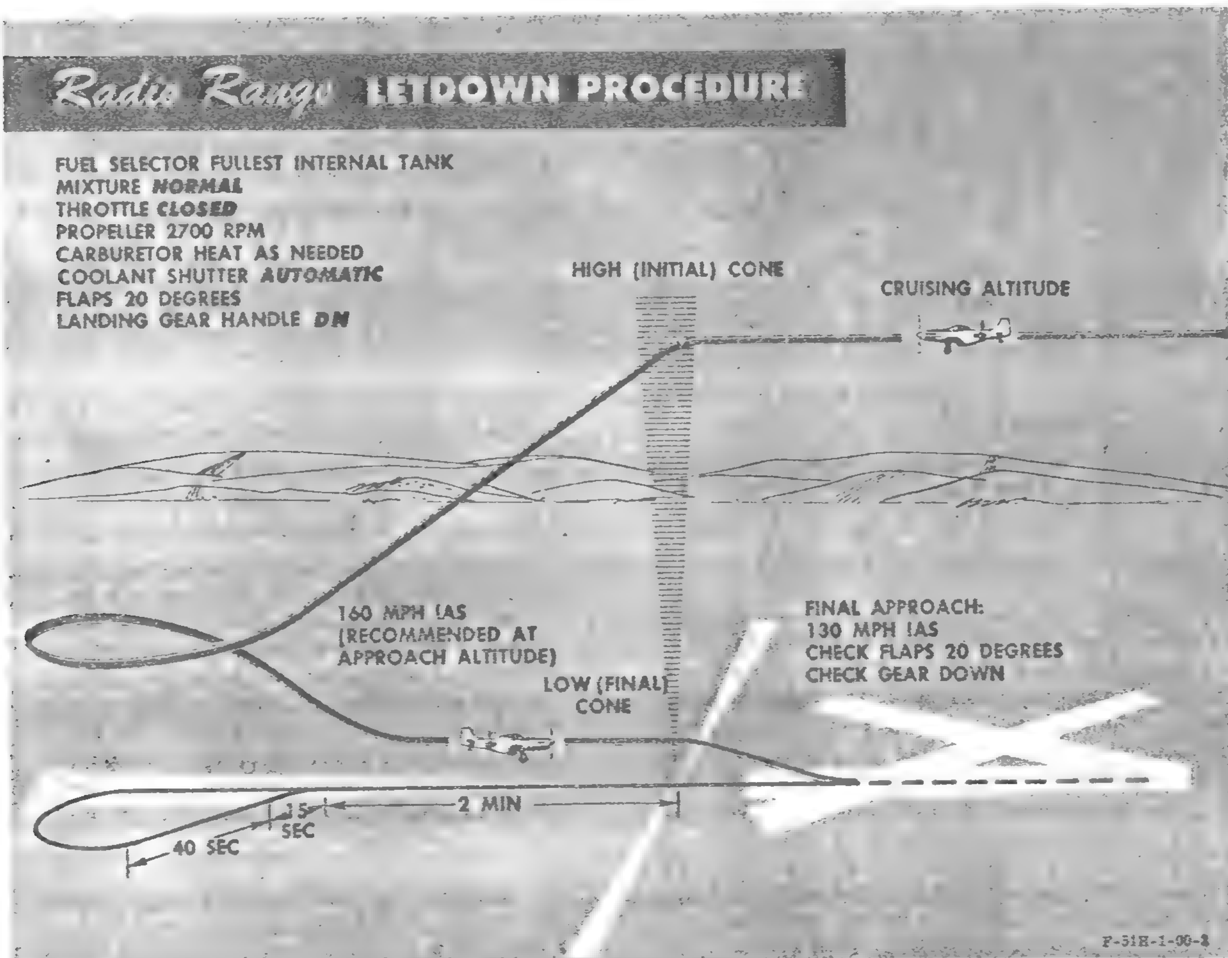


Figure 9-1

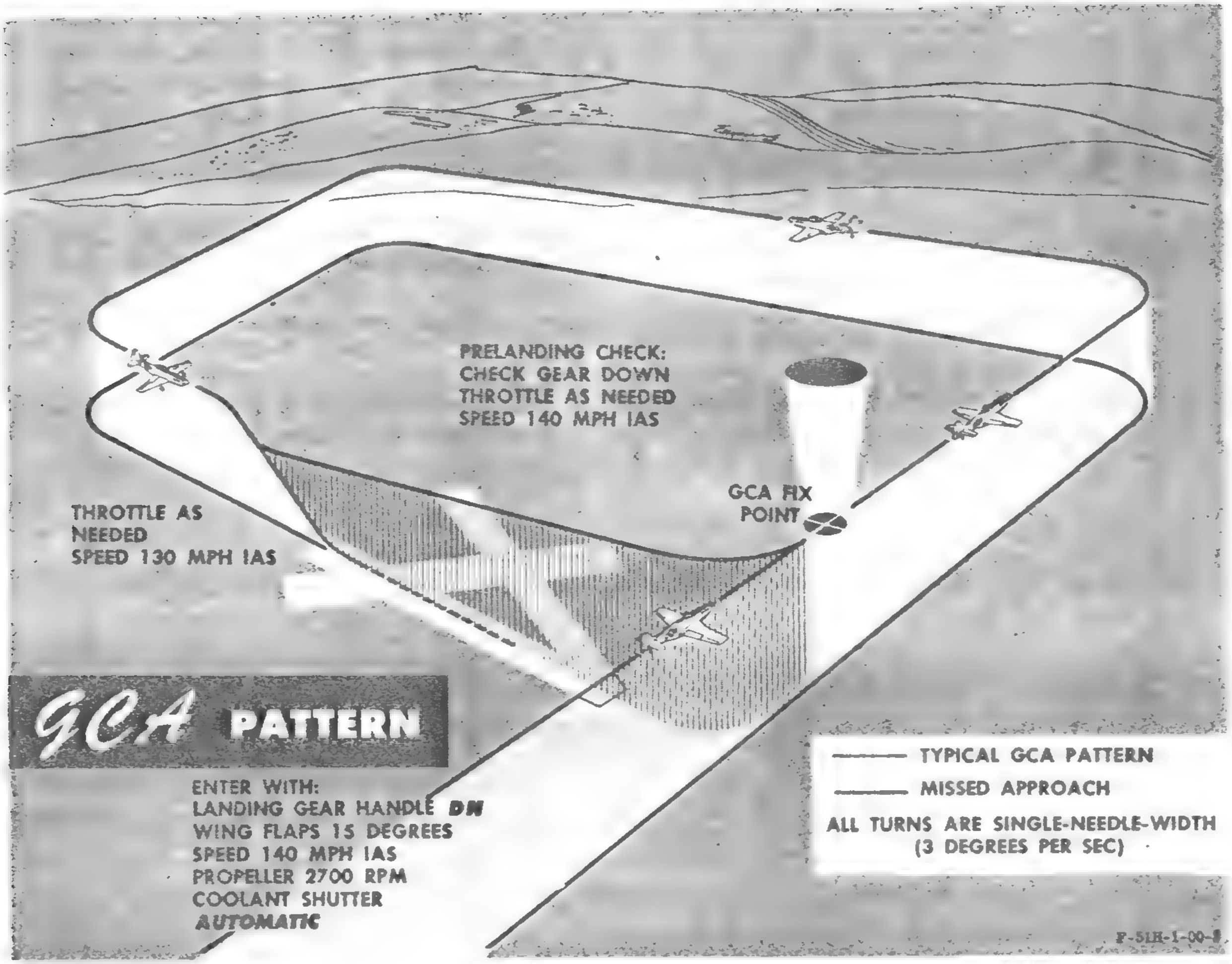


Figure 9-2

3. Landing gear up.
4. Raise flaps when at least 200 feet above ground and sufficient airspeed is reached.

ICING.

Ice normally adheres to the windshield, wing, stabilizer, and vertical fin leading edges and also to the forward portions of the drop tanks. At the first sign of icing, change altitude immediately to get out of icing layer. Ice accumulations increase drag and decrease lift, requiring an increase in power to maintain altitude and airspeed. During icing conditions if engine starts to run rough, immediately put carburetor air control lever in HOT AIR UNRAMMED position to prevent carburetor ice and remove any ice present. If ice accumulates on wings, make wide, shallow turns at a greater speed than normal, especially during approach. Use flaps with care. Remember, stalling speed increases with ice. Be sure pitot heater is on during icing conditions.

FLIGHT IN TURBULENCE AND THUNDERSTORMS.

CAUTION

Flight through a thunderstorm should be avoided if at all possible. Thunderstorm flying demands considerable instrument experience and should intentionally be undertaken only by well-qualified pilots. However, many routine flight operations require a certain amount of thunderstorm flying, since it is not always possible to avoid storm areas. At night, it is often impossible to detect individual storms and find the in-between clear areas.

Note

Normally, the least turbulent area in a thunderstorm is at altitudes of 6000 feet or less above the terrain. Altitudes between 10,000 and 20,000 feet are usually the most turbulent.

Warning

A pilot using modern equipment and possessing a combination of proper experience, common sense, and instrument flying proficiency can safely fly thunderstorms.

BEFORE TAKE-OFF.

Note the following precautions:

1. Make a thorough analysis of the general weather situation to determine thunderstorm areas, and prepare a flight plan which will avoid thunderstorm areas whenever possible.

2. Be sure to check proper operation of all flight instruments, navigational equipment, pitot heater, carburetor air heat, and cockpit lighting before attempting flight through thunderstorm areas.

APPROACHING THE STORM.

It is imperative that you prepare the airplane before entering a zone of turbulent air. If a storm cannot be seen, its proximity can be detected by radio crash static. Prepare the airplane as follows:

1. Accurately fix position before actually entering thunderstorm area.

2. Reduce cruising speed power settings for comfortable penetration speed. (See figure 9-3.)

3. Set mixture control for smooth engine operation.

4. Pitot heater on.

5. Carburetor air control lever adjusted as required.

6. Check suction gage for proper reading and gyro instruments for correct settings.

7. Turn off any radio equipment rendered useless by static.

8. Tighten safety belt and lock shoulder harness.

9. At night, turn cockpit light full bright, adjust seat low, and don't stare outside of airplane.

CAUTION

Do not lower landing gear or flaps, as they decrease the aerodynamic efficiency of the airplane.

IN THE STORM.

When in the thunderstorm, follow this procedure:

1. Throughout storm, maintain power settings and pitch attitude established before entering storm, unless airspeed falls off to 60 percent above power-on stalling speed or unless airspeed increases to approximately 30 percent above your penetration speed.

2. Devote all attention to flying airplane.

3. Expect turbulence, precipitation, and lightning. Don't allow these conditions to cause undue concern.

4. Maintain attitude. Concentrate mainly on remaining level by reference to gyro horizon.

5. Maintain original heading. Do not make any turns unless it is absolutely necessary.

6. Don't chase airspeed indicator, since doing so will result in extreme airplane attitudes. Should a sudden gust be encountered while the airplane is in a nose-high attitude, a stall might easily result. Because of rapid changes in vertical gust velocity or rain clogging the pitot tube, airspeed may momentarily fluctuate as much as 70 mph.

7. To minimize stresses imposed on airplane, use as little longitudinal control as possible to maintain your attitude.

8. The altimeter may be unreliable in thunderstorms because of differential barometric pressure within the storm. A gain or loss of several thousand feet may be expected. Make allowance for this error in determining minimum safe altitude.

NIGHT FLYING

There are no predominant differences between night-flying procedures and day-flying procedures. Exhaust glare obviously is more pronounced during night flight (unless flame arresters have been installed), but should not be cause for alarm. Refer to Section II for night flight interior check and take-off and landing procedures.

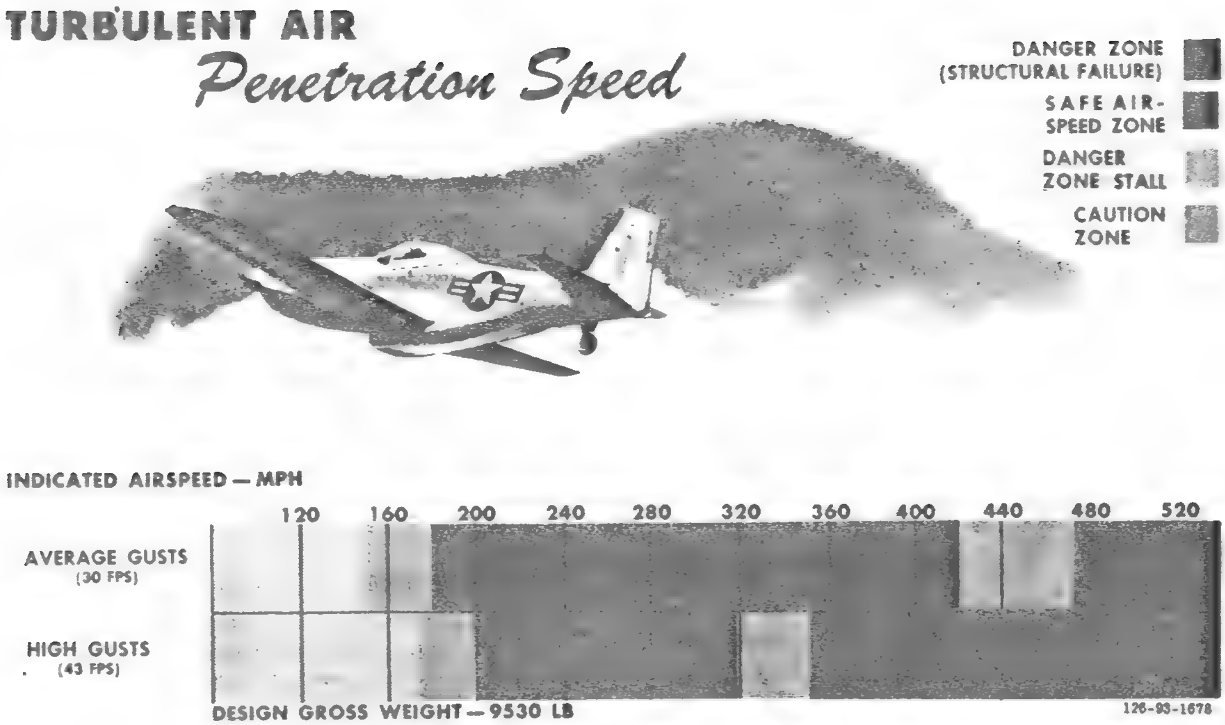


Figure 9-3

COLD-WEATHER PROCEDURES

During cold-weather operation, normal operating procedures, as outlined in Section II, must be revised to include special inspection requirements and operating procedures necessitated by arctic conditions. Successful low-temperature operation is dependent upon the procedures that follow, especially those preparations made during engine shutdown and post-flight servicing.

BEFORE ENTERING AIRPLANE.

1. Make a thorough check of airplane for freedom from frost, snow, and ice. Include airplane surfaces, controls, shock struts, hydraulic pistons, vents, breathers, etc. Make sure that all protective covers and excluder plugs have been removed.

2. Check that engine has been preheated in accordance with following chart:

PREHEAT CHART

OUTSIDE AIR TEMPERATURE	PREHEAT TIME (MINUTES)
Above −18°C (0°F)	0
−18°C to −23°C (0°F to −10°F)	10
−23°C to −29°C (−10°F to −20°F)	20
−29°C to −34°C (−20°F to −30°F)	30
−34°C to −40°C (−30°F to −40°F)	40
−40°C to −46°C (−40°F to −50°F)	50
−46°C to −51°C (−50°F to −60°F)	60
−51°C to −54°C (−60°F to −65°F)	65

Note

The preheat times given in the chart are approximate and are based on preheating with a standard F-1A heater with one duct rerouted to the heater intake. Pull propeller through manually to determine need for additional preheat.

3. For temperatures below −12°C (10°F), drain oil system and refill with warm oil before flight.

ON ENTERING AIRPLANE.

1. Check that cockpit, instrument panel, and windshield have been preheated when temperature is below −4°C (25°F).

2. Check controls and trim tabs for proper operation.

3. Make sure that all preheat equipment has been removed.

4. Make sure that an adequate auxiliary power cart is connected.

5. Check that propeller can be pulled through manually and that there is fluid oil at "Y" drain immediately before attempting start.

STARTING ENGINE.

Make a normal start, following the procedure given in Section II, as soon as possible after propeller is pulled through. More than normal priming is required at low temperatures during the starting procedure and immediately after combustion until smooth engine operation is obtained. It is not considered harmful to prime continuously when necessary during the entire cranking period, but prime only when the engine is turning over.

CAUTION

> Do not open mixture control until engine is firing.

If engine has not started after 2 minutes of cranking, disengage starter and allow starter to cool for one minute before making another attempt. If the engine fails to start, moisture on the spark plugs may be the cause. Remove at least one plug from each cylinder and dry the points. Make another attempt to start engine after replacing plugs.

CAUTION

> If there is no oil pressure after 30 seconds running, or if the pressure drops to 0 after a few minutes of ground operation, stop engine immediately and investigate.

WARM-UP AND GROUND CHECK.

1. Move carburetor air control lever to FILTERED AIR position and then to HOT AIR UNRAMMED position after engine is started, to improve fuel vaporization and combustion and to reduce backfiring.

2. Do not increase engine speed above 1500 rpm until oil temperature rises to 20°C (68°F).

3. Ground-run engine for 30 minutes to remove excess fuel from oil if there is any possibility of over-dilution.

4. Use firmly anchored wheel chocks for engine run-ups. Tie tail securely before attempting a full-power run-up.

5. Check wing flap operation.

TAXIING.

To preserve battery life, use only essential electrical equipment while taxiing at low engine speeds.

BEFORE TAKE-OFF.

1. Hold brakes and run up engine until spark plugs burn clean and engine is operating smoothly before checking magnetos.

2. Check flight controls for freedom of movement.

3. Use carburetor heat as required to keep carburetor air temperature within limits, to improve engine operation during take-off.

TAKE-OFF.

At the start of take-off run, advance throttle as rapidly as possible, to ensure that rated Take-off Power is obtainable. Discontinue take-off if required power is not available.

AFTER TAKE-OFF.

1. After take-off from a wet- snow- or slush-covered runway, operate landing gear and flaps through several complete cycles to preclude their freezing.

2. Turn on gun and gun camera heaters.

3. Adjust carburetor air control lever as necessary to prevent carburetor icing.

ENGINE OPERATION IN FLIGHT.

Use carburetor heat as required to improve fuel vaporization and combat carburetor ice, but do not use carburetor heat at altitude, as resultant excessively lean mixtures will cause engine roughness.

CAUTION

> Because of the constant-speed propeller and the automatic manifold pressure regulator, it is difficult to detect carburetor ice formation except by irregular engine operation, since neither engine speed nor manifold pressure should vary.

OPERATION OF AIRPLANE SYSTEMS DURING FLIGHT.

1. Operate cockpit heating and defrosting systems as required.

2. Increase propeller speed momentarily by aproximately 200 rpm every half hour to ensure continued

governing at extremely low temperatures. Return to desired cruising rpm as soon as tachometer indicates proper governing.

3. Stay on a prearranged flight course as closely as possible, so that searchers will be able to find you if you are forced down. Except in extreme emergency, it is better to land or crash-land than to bail out.

DESCENT.

Temperature inversions are common in winter, and the ground temperature may be 15°C to 30°C (27°F to 54°F) colder than that at altitude. Therefore, be careful to avoid excessive engine cooling when letting down. To avoid fogging of canopy, turn defroster knob to ON before descent. Lower landing gear and use flaps to reduce airspeed while descending. Retain considerable power, and if possible, maintain oil temperature above 20°C and coolant temperature above 60°C during all letdowns. Lower readings than these may result in the engine cutting out or failing to respond when the throttle is advanced.

APPROACH.

Note

When the outside air temperature is 0°C (32°F) or lower, it is advisable to use carburetor heat during landing, to obtain better vaporization of fuel. This also helps prevent the engine from cutting out.

1. Turn off all nonessential electrical equipment at least one minute before final approach, to reduce battery load when generator cuts out.

2. Pump brakes to chip away any accumulated ice.

STOPPING ENGINE.

1. Dilute engine in accordance with the following table for anticipated starting temperatures. Maintain oil temperature below 50°C (122°F), oil pressure above 15 psi, and 1300 to 1500 rpm during dilution period. Shut down engine with dilution switch engaged.

2. The following table gives dilution time for both standard dilution orifice (0.0625-inch diameter) and winterized orifice (0.111-inch diameter). The portion of the chart below the line (in excess of 10 percent dilution) is included for airplanes equipped with a Thompson centrifuge.

DILUTION TABLE

Temperature	Standard Minutes	Orifice (0.0625 in.) Percent Dilution	Winterized Minutes	Orifice (0.111 in.) Percent Dilution
−12°C (10°F)	3		1.5	
−18°C (0°F)	4	10	2.0	10
−21°C (−5°F)	5		2.5	
−23°C (−10°F)	6		3.0	
−26°C (−15°F)	7		3.5	
−29°C (−20°F)	8	20	4.0	20
−32°C (−25°F)	9		4.5	
−34°C (−30°F)	10		5.0	
−37°C (−35°F)	11		5.5	
−40°C (−40°F)	12	30	6.0	30

Note

- Do not dilute oil in excess of 10 percent unless a Thompson centrifuge is installed on engine. Dilution over 10 percent will cause dangerous loss of oil at high power settings.
- It has been determined through tests conducted on V-1650 engines that diluting the oil more than 10 percent will cause the scavenge system to fail. Therefore, restrict period of oil dilution to a *maximum* of 3 minutes. When outside air temperature is such that 3 minutes oil dilution is insufficient, drain oil and refill system with warm oil before starting engine.

3. Store unwinterized airplanes in warm hangar if anticipated starting temperatures are below −18°C (0°F).

BEFORE LEAVING AIRPLANE.

1. Release brakes after wheels are chocked.

2. Leave canopy slightly open to allow air circulation within cockpit, to prevent canopy cracking from differential contraction and to decrease windshield and canopy frosting.

3. Whenever possible, leave airplane parked with full fuel tanks.

4. Remove battery when airplane is parked outside at temperatures below −29°C (−20°F) for more than 4 hours or for any extended period of time.

HOT-WEATHER AND DESERT PROCEDURES

In general, hot-weather and desert procedures differ from normal procedures mainly in that additional precautions must be taken to protect the airplane from damage due to high temperatures and duct. Particular

care should be taken to prevent the entrance of sand into the various airplane components and systems (engine, fuel system, pitot-static system, etc). All filters should be checked more often than under normal conditions. Units incorporating plastic and rubber parts should be protected as much as possible from excessive temperatures. Tires should be checked frequently for signs of blistering, etc.

BEFORE ENTERING AIRPLANE.

Check airplane for freedom from sand and dust (fungi in tropic climates). Include control hinges, hydraulic pistons, shock struts, etc, in this check.

ON ENTERING AIRPLANE.

1. Check control and trim tab operation for freedom of movement.
2. Check instruments and cockpit for freedom from sand and dust (fungi in tropics).

STARTING ENGINE.

1. Use normal starting procedure given in Section II. Avoid overpriming.
2. Use filtered carburetor air for starting and ground operation as required.

WARM-UP AND GROUND CHECK.

Restrict ground operation to a minimum, to prevent overheating. Maintain a constant check on carburetor air and coolant temperature.

BEFORE TAKE-OFF.

Avoid take-off in a sand or dust storm when possible. Park airplane cross-wind and shut down engine.

TAKE-OFF.

1. Anticipate a longer take-off roll in high temperatures.
2. Check carburetor air and coolant temperatures closely during take-off.

APPROACH.

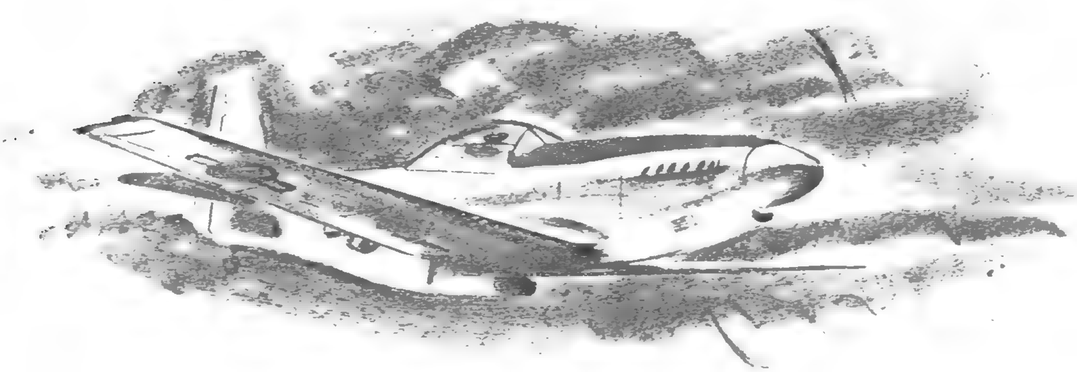
Move carburetor air control lever to FILTERED AIR for landing.

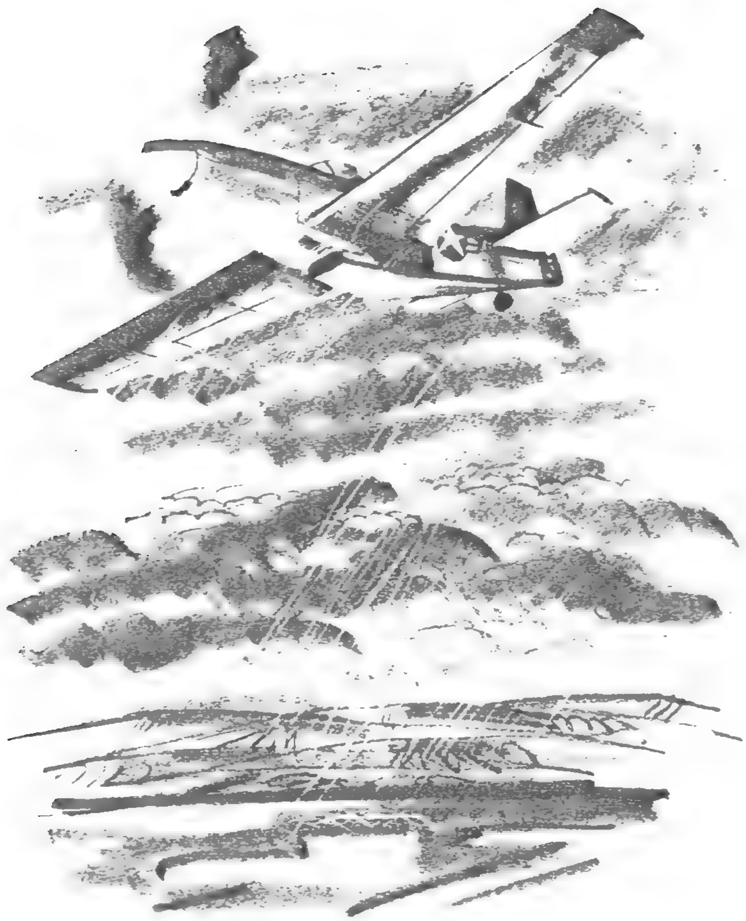
ENGINE SHUTDOWN.

Shut down engine immediately on parking, to prevent overheating.

BEFORE LEAVING AIRPLANE.

1. Leave canopy partly open to permit air circulation within cockpit.
2. Make sure that protective covers and excluder plugs are installed on engine, canopy, pitot tube, air ducts, etc.





Operating Data

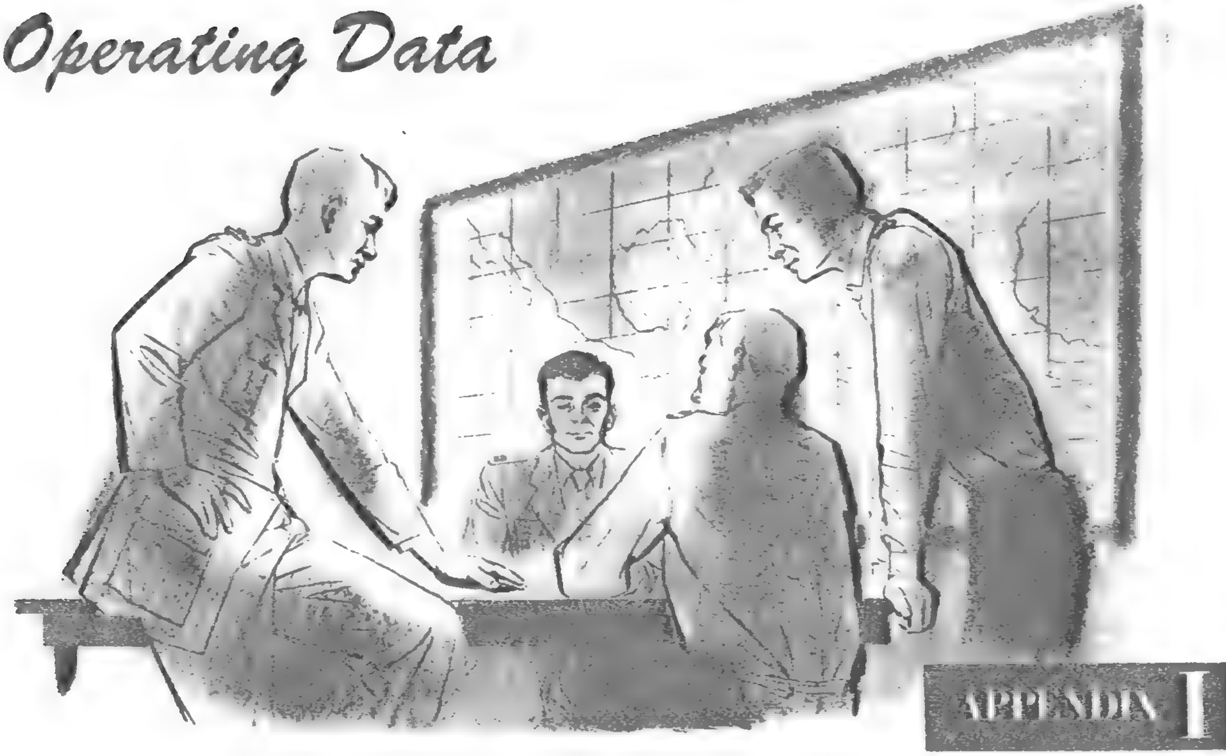


TABLE OF CONTENTS.

INTRODUCTION.

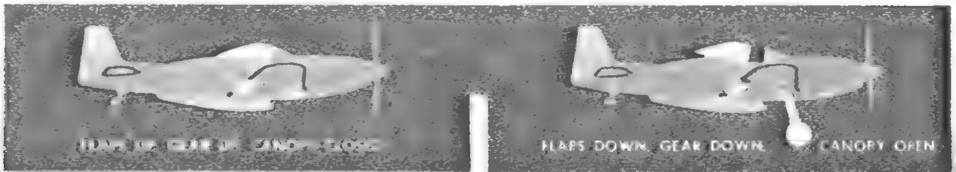
There are two ways to perform a mission. The right way can be determined from the information presented in the charts on the following pages. If a pilot chooses to ignore the charts, he can fly any mission confident that the airplane is capable of greater performance than he is capable of obtaining from it. These charts, which are easy to interpret, enable you to fly a greater distance at better cruising speed and arrive at your destination with more reserve fuel. A description of each chart and a sample problem to illustrate a typical training mission are also included.

AIRSPEED INSTALLATION AND COMPRESSIBILITY CORRECTION.

An Airspeed Installation Correction table (figure A-1) permits computing calibrated airspeed (CAS) from indicated airspeed (IAS). Indicated airspeed is the airspeed indicator reading. Calibrated airspeed is indicated airspeed corrected for installation error. An Airspeed Compressibility Correction table (figure A-1) permits computing equivalent airspeed (EAS) from calibrated airspeed (CAS). Equivalent airspeed (EAS) is calibrated airspeed corrected for compressibility error. True airspeed is equivalent airspeed corrected for atmospheric density.

AIRSPEED INSTALLATION CORRECTION

APPLY CORRECTION TO INSTRUMENT READING TO OBTAIN CALIBRATED AIRSPEED



IAS—MPH	CORRECTION	IAS—MPH	CORRECTION
100	0	80	-3
120	0	90	-2
140	0	100	-1
160	1	110	0
180	1	120	0
200	1	130	1
220	1	150	2
240	1	170	3
260	2		
280	2		
300	2		
350	2		
400	3		

AIRSPEED COMPRESSIBILITY CORRECTION

SUBTRACT CORRECTION FROM CALIBRATED AIRSPEED TO OBTAIN EQUIVALENT AIRSPEED

PRESSURE ALTITUDE	CALIBRATED AIRSPEED — MPH							
	150	200	250	300	350	400	450	500
5,000	0	0	1	1	2	3	4	5
10,000	0	1	2	3	4	6	8	
15,000	0	1	3	4	7	9		
20,000	1	2	4	6	10	14		
25,000	1	3	5	9	13			
30,000	2	4	7	12	18			
35,000	2	5	10	16				

126-93-1736

Figure A-1

FREE AIR TEMPERATURE CORRECTION.

Since no free air temperature gage is provided in this airplane, a chart for converting indicated carburetor air temperature to free air temperature is given in figure A-2. The corrected free air temperature can be used with calibrated airspeed to obtain true airspeed.

EXAMPLE — USE OF CORRECTION TABLES.

An airplane is flying at 25,000 feet pressure altitude. Indicated carburetor air temperature is −15°C, and the indicated airspeed reading is 300 mph. What is the true airspeed?

Airspeed indicator reading (IAS)	300 mph
Correction for installation error	2 mph
Calibrated airspeed (CAS)	302 mph
Indicated carburetor air temperature	−15.0°C
Correction to obtain free air temperature	−19.0°C
Corrected free air temperature	−34.0°C

Use these values of CAS and free air temperature with a Type D-4 or Type G-1 airspeed computer to determine the true airspeed of 438 mph.

When a Type AN5835-1 dead-reckoning computer is used, CAS usually must be corrected for compressibility error.

Calibrated airspeed (CAS)	302 mph
Compressibility error	−9 mph
Equivalent airspeed (EAS)	293 mph

Use this value of EAS with the dead-reckoning computer to determine the true airspeed of 438 mph.

TAKE-OFF DISTANCES.

A Take-off Distances chart (figure A-5) gives take-off ground-run distances and total distances to clear a 50-foot obstacle, tabulated for several different gross weights, altitudes, and temperatures on a hard-surface runway. Distances given are for normal flaps-up take-offs. For a minimum-run take-off, refer to Section II.

CLIMB.

Best climb speed, fuel consumption, time to climb, and rate of climb (using Military Power or Normal Power) can be determined for different configurations from the Military Power and Normal Power Climb charts (figures A-6 and A-7). A fuel allowance for warm-up, taxi, and take-off is listed in the column labeled "SEA

FREE AIR TEMPERATURE *Correction Chart*

ALTITUDE—FEET	INDICATED AIRSPEED—MPH				
	150	200	250	300	350
0		4	6	8	9
5,000		4	7	9	11
10,000		5	8	11	12
15,000	4	6	9	13	15
20,000	5	8	11	16	18
25,000	6	9	13	19	21
30,000	7	11	17	22	24
35,000	8	13	20		
40,000	10	17	24		
45,000	12	21			

SUBTRACT CORRECTION SHOWN FROM CARBURETOR AIR TEMPERATURE TO OBTAIN FREE AIR TEMPERATURE IN DEGREES CENTIGRADE

DATA BASIS: FLIGHT TEST
DATA AS OF: 9-2-53

109-93-1745

Figure A-2

LEVEL." Fuel requirements listed at other altitudes include this allowance plus the fuel required to climb from sea level. Fuel required for an in-flight climb from one altitude to another is the difference between the tabulated fuel rquired to climb to each altitude from sea level.

LANDING DISTANCES.

The Landing Distances chart (figure A-8) shows the distances required for ground roll and for landing over a 50-foot obstacle. Distances for landings on a hard-surface runway are furnished for several altitudes and gross weights. Best speeds are shown for power-off approach. Distances given are airplane requirements under normal service conditions with no wind and with flaps full down.

MAXIMUM ENDURANCE.

Airspeeds, power settings, and fuel flow rates for maximum endurance flight are shown in the Maximum Endurance chart (figure A-10) for several configurations and altitudes. The Maximum Endurance chart gives the power settings and fuel flows for maximum *time* in the air and should not be confused with the "MAXIMUM AIR RANGE" section of any Flight Operation Instruction Chart, in which the power setting and fuel flows are for maximum *distance*, not maximum *time*.

COMBAT ALLOWANCE.

The Combat Allowance chart (figure A-9) shows the variation with altitude in manifold pressure and fuel flow at Take-off Power (Military Power).

FLIGHT OPERATION INSTRUCTION CHARTS.

To assist in selecting the engine operating conditions required for obtaining various ranges, Flight Operation Instruction Charts (figures A-11 through A-14) are provided. Each chart is divided into five main columns. Data listed under Column I is for emergency high-speed cruising at Maximum Continuous Power. Operating conditions in Columns II, III, IV and V give progressively greater ranges at lower cruising speeds. Ranges shown in any column for a given fuel quantity can be obtained at various altitudes by use of the power settings listed in the lower half of the chart in the same column. The speeds quoted on the chart are those obtained with gross weight equal to the high limit of the chart weight band. Speeds are shown to the nearest 5 mph. No allowances are made for wind, navigational error, simulated combat, formation flights, etc; therefore, such allowances must be made as required.

USE OF CHARTS.

To use the charts, first select the Flight Operation Instruction Chart applicable to your flight plan, determined in this airplane by gross weight at take-off and by external load. Then enter the chart at a fuel quantity equal to, or less than, the total amount in the airplane minus all allowances. (Ranges listed for each fuel quantity are based on use of the entire quantity in level flight when cruising at the recommended operating conditions.) Fuel allowance for warm-up, taxi, take-off, and climb is obtained from the desired climb chart (figure A-6 or A-7). Other allowances based on the type of mission, terrain over which the flight is to be made, and weather conditions are dictated by local policy. If your flight plan calls for a continuous flight at reasonably constant cruising power, compute the fuel required and flight time as for a single-section flight. Otherwise, the flight must be broken up into sections and each leg of the flight planned separately. The flight plan may be changed at any time en route, and the chart will show the remaining range available at various cruising powers and altitudes if the instructions printed at the top of the chart are followed.

SAMPLE PROBLEMS.

PROBLEM 1.

A bombing run must be made on a target 186 statute miles from the home field. A secondary target, 70 statute miles from the bomb target and 239 miles from the home field, is to be strafed to lend ground support. Military Power will be used during the runs on both target areas. The bomb run will be initiated from 5000 feet altitude, the gunnery runs will be made at sea level plus 50 feet, and run-in to the bomb target will be made "on the deck" (sea level plus 50 feet) to avoid radar detection. The run to the secondary target will be made "on the deck" as well. Maximum Continuous Power will be used on both of these legs. After completion of the gunnery runs, a climb from sea level to 10,000 feet will be made on course to the home field. Cruise back will be at 10,000 feet. (See figure A-4.)

Write down the conditions of the problem:

Required range.....495 statute miles
Weather..................CAVU
Winds.....................0 mph on all legs
Airplane basic
weight............. 7135 pounds (includes trapped fuel and oil, and miscellaneous equipment)

Crew weight (one) .... 230 pounds
Oil (13.75 gal).... 104 pounds
Maximum internal fuel (260 gal) ....1560 pounds
K-14B gun sight 140 pounds
Armament..........1590 pounds (includes 1800 rounds ammunition, gun camera, two 500-pound general-purpose bombs, and items necessary for installation)
Total gross weight..........10,759 pounds

Now that the conditions of the flight are determined, it is necessary to establish a flight plan. Since the charts give only cruise ranges under no-wind conditions and do not include any reserves, it is necessary first to compute all allowances and reserves that will be required to cover warm-up, take-off, climb, Military Power operation, and any unexpected difficulties. Determine fuel available for cruise flight by deducting necessary fuel allowances and reserves from actual fuel aboard as follows:

General reserve for unexpected difficulties.. 53 gallons

Note in Column IV of figure A-14 that at 5000 feet, 53 gallons of fuel represents one hour's flying time. A one-hour fuel reserve is considered sufficient for this mission.

Warm-up, take-off, and climb to 50 feet ....15 gallons

The Normal Power Climb chart (figure A-6) shows that 15 gallons is required for warm-up, take-off, and climb to 50 feet.

Military Power allowance................30 gallons

This figure is obtained by multiplying the Military Power fuel consumption at sea level (given in the Combat Allowance chart, figure A-9) by the total time spent at this power; i.e., 5 minutes on bomb target plus 5 minutes ground support (10 minutes × 3.0 gpm = 30 gallons).

Climb from sea level to 5000 feet.... 7 gallons

The Normal Power Climb chart (figure A-6) shows that 22 gallons is required to climb to 5000 feet, less 15 gallons warm-up and take-off allowance, or 7 gallons (22 − 15 = 7 gallons). Observe that a distance of 15 statute miles is covered during the climb to bomb-run altitude. Therefore, the climb to bombing altitude should be started 15 miles out from the target for arrival over the target at the proper altitude.

Descent to sea level from 5000 feet ... 0 gallons

The descent from bombing altitude to sea level plus 50 feet (the altitude used for run-in on ground support target) is considered to be included in the fuel used during the bomb run at Military Power.

Climb from sea level to 10,000 feet.... 9 gallons

After the gunnery runs are completed, the airplane is flown to 10,000 feet on course to the home field. The Normal Power Climb chart (figure A-6) shows that 24 gallons is required to climb to 10,000 feet, less 15 gallons warm-up and take-off allowance, or 9 gallons (24 − 15 = 9 gallons). During the climb, a distance of 19 statute miles is covered.

Collecting all the required fuel allowances:

General reserve for unexpected difficulties	53 gallons
Warm-up, take-off, and climb to 50 feet	15 gallons
Military Power allowance	30 gallons
Climb from sea level to 5000 feet	7 gallons
Descent to sea level from 5000 feet	0 gallons
Climb from sea level to 10,000 feet	9 gallons
Total fuel allowance	114 gallons

Therefore, the actual fuel available for cruising is 146 gallons (260 − 114 = 146 gallons). In the climb from sea level to 5000 feet, a total of 15 statute miles was covered, so the total range, on the first leg, to be flown with Maximum Continuous Power is 171 statute miles (186 − 15 = 171 miles). By reference to figure A-11, the fuel required can be determined from Column 1, at sea level (Maximum Continuous Power operation). Range divided by true airspeed, then multiplied by fuel flow, gives fuel required; i.e., 171 miles ÷ 287 mph = 0.596 hour, and 0.596 hour × 95 gph = 57 gallons. This leaves 89 gallons for the remaining two legs (146 − 57 = 89 gallons). The second leg is figured the same as the first, using figure A-14; remember, the bombs were disposed of, at the end of the first leg. Column I (figure A-14) shows a true airspeed of 308 mph with a fuel flow of 95 gph. The fuel required for the second leg of 70 statute miles is 22 gallons (70 ÷ 308 = 0.227 hour, and 0.227 hour × 95 gph = 22 gallons). This leaves 67 gallons (89 − 22 = 67 gallons) for the homeward-bound leg. Since 19 statute miles of this leg is covered climbing to 10,000 feet, this leaves a distance of 220 statute miles to be flown at 10,000 feet with the wing rack configuration. By interpolation in figure A-14, it can be seen that the remaining 67 gallons give an ample range to complete the mission, using the power settings in Column II, III, IV, or V.

Going from Column II to Column V gives a progressive increase in range at a sacrifice in speed, as well as an added reserve. Suppose Column II is picked; the fuel required will be 52 gallons (220 miles ÷ 342 mph = 0.644 hour, and 0.644 hour × 89 gph = 52 gallons).

This gives a 15-gallon surplus (67 − 52 = 15 gallons) which, if added to the original reserve quantity, gives a total reserve of 68 gallons (53 + 15 = 68 gallons). This, then, is a quick solution to the problem.

PROBLEM 2.

Suppose that the estimate of 5 minutes of Military Power at each of the targets was too low, and the actual time spent was 10 minutes per target. Therefore, the original 30-gallon Military Power allowance must be increased to 60 gallons (20 minutes × 3.0 gpm = 60 gallons), and consideration of the remainder of the mission must be made during flight. If the remaining leg of the mission is flown as originally planned (Column 11, figure A-14), the additional Military Power allowance may be subtracted from the allowed reserve of 68 gallons, leaving a reserve at the end of the mission of 38 gallons. However, if a greater reserve is desired, the last leg of the mission may be flown at slightly lower power settings and speeds, such as those listed in Column IV of figure A-14. Note in Column IV that the remaining 220 statute miles of cruising requires only 45 gallons of fuel. This compares with the 52 gallons required to travel the same distance using Column II power settings. The net saving in fuel, by using Column IV instead of Column II, is 7 gallons (52 − 45 = 7 gallons), which at 5000 feet represents an additional 0.132 hour at maximum range or the equivalent of 33 additional statute miles (7 gallons ÷ 53 gph = 0.132 hour, and 0.132 hour × 252 mph = 33 statute miles).

If for some reason the 68-gallon reserve is to be considered for a holding or orbiting procedure where *time* in the air is important rather than range, consult figure A-10 to determine that the 68-gallon reserve represents 1.70 hours of flying time at 5000 feet (68 gallons ÷ 40 gph = 1.70 hours).

War Emergency Power

WET — COMBAT EMERGENCY

PRESSURE ALTITUDE (FT)	MANIFOLD PRESSURE	SUPER-CHARGER	FUEL GPM
34,000	F.T.	HIGH	2.5
32,000	F.T.	HIGH	2.5
30,000	F.T.	HIGH	3.0
28,000	F.T.	HIGH	3.0
26,000	F.T.	HIGH	3.0
24,000	80	HIGH	3.0
22,000	80	HIGH	3.0
20,000	80	HIGH	3.0
18,000	F.T.	LOW	2.5
16,000	F.T.	LOW	3.0
14,000	F.T.	LOW	3.0
12,000	80	LOW	3.5
10,000	80	LOW	3.5
8,000	80	LOW	3.5
6,000	80	LOW	3.5
4,000	80	LOW	3.5
2,000	80	LOW	3.5
SL	80	LOW	3.5

TIME LIMIT—LIMITED BY WATER SUPPLY AVAILABLE (APPROXIMATELY 7 MINUTES)

MIXTURE — [illegible] RPM — 3000

WATER INJECTION SWITCH — ON

REMARKS:
Standard temperature

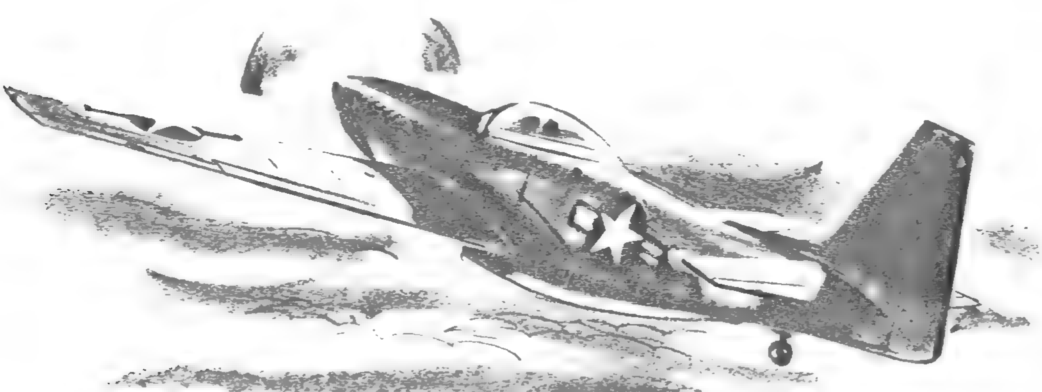
LEGEND
GPM — Approx US gal per minute
F.T. — Full throttle

BASED ON FLIGHT TESTS

DATA AS OF 9-17-45

F-51H-1-93-8

Figure A-3



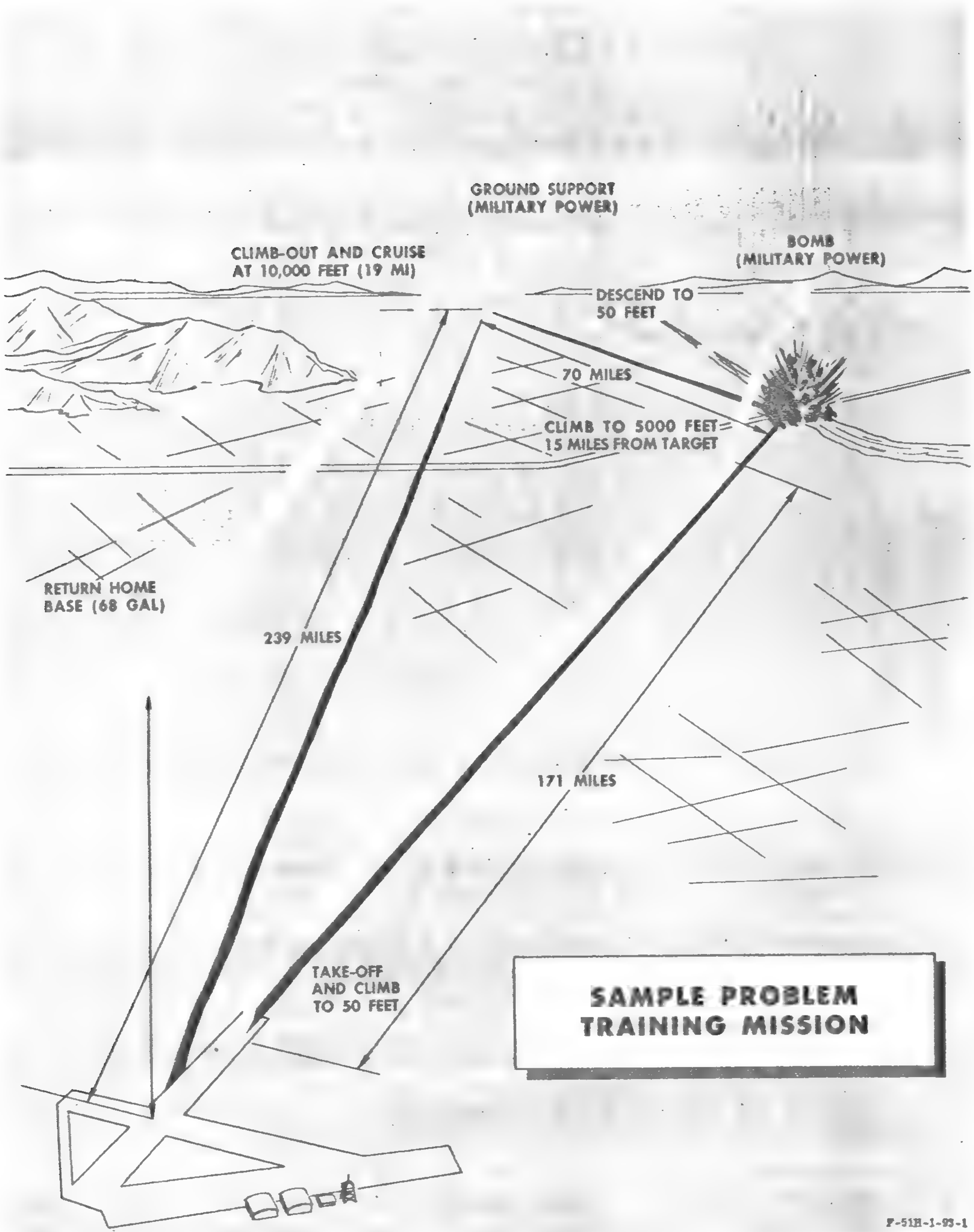

GROUND SUPPORT
(MILITARY POWER)
BOMB
(MILITARY POWER)
CLIMB-OUT AND CRUISE
AT 10,000 FEET (19 MI)
DESCEND TO
50 FEET
70 MILES
CLIMB TO 5000 FEET
15 MILES FROM TARGET
RETURN HOME
BASE (68 GAL)
239 MILES
171 MILES
TAKE-OFF
AND CLIMB
TO 50 FEET
SAMPLE PROBLEM
TRAINING MISSION
F-51H-1-93-1

Figure A-4

WADC
Form 241G
(11 Jun 51)

TAKE-OFF DISTANCES

(FEET)

HARD-SURFACE RUNWAY

MODEL: F-51H

ENGINE (S): (1) V-1650-9

GROSS WEIGHT	PRESSURE ALTITUDE	-5 DEGREES CENTIGRADE				+15 DEGREES CENTIGRADE				+35 DEGREES CENTIGRADE				+55 DEGREES CENTIGRADE			
		ZERO WIND		30-KNOT WIND		ZERO WIND		30-KNOT WIND		ZERO WIND		30-KNOT WIND		ZERO WIND		30-KNOT WIND	
		GROUND RUN	TO CLEAR 50 FT OBST.	GROUND RUN	TO CLEAR 50 FT OBST.	GROUND RUN	TO CLEAR 50 FT OBST.	GROUND RUN	TO CLEAR 50 FT OBST.	GROUND RUN	TO CLEAR 50 FT OBST.	GROUND RUN	TO CLEAR 50 FT OBST.	GROUND RUN	TO CLEAR 50 FT OBST.	GROUND RUN	TO CLEAR 50 FT OBST.
13,000 LB	SL	2100	3150	1100	1800	2600	3700	1400	2150	3100	4350	1700	2550	3600	5050	2050	3050
	1000	2300	3400	1250	1950	2800	4000	1550	2350	3350	4650	1900	2800	3950	5450	2300	3350
	2000	2500	3650	1350	2150	3050	4350	1700	2600	3700	5100	2100	3100	4350	5950	2600	3650
	3000	2750	3950	1500	2300	3350	4750	1900	2850	4050	5550	2400	3400	4800	6550	2900	4050
	4000	3000	4300	1700	2500	3700	5150	2150	3100	4450	6050	2650	3800	5350	7200	3200	4500
	5000	3300	4650	1850	2750	4100	5600	2400	3450	4900	6650	3000	4200	5900	7950	3650	5150
12,000 LB	SL	1750	2700	900	1500	2100	3150	1100	1750	2500	3600	1300	2100	2900	4150	1600	2450
	1000	1900	2900	1000	1650	2300	3400	1200	1900	2750	3900	1500	2300	3200	4500	1750	2650
	2000	2100	3150	1100	1750	2500	3650	1350	2100	3000	4250	1650	2500	3550	4900	2000	2950
	3000	2300	3400	1200	1900	2750	3950	1500	2300	3300	4650	1850	2750	3900	5400	2250	3250
	4000	2550	3700	1350	2100	3050	4300	1700	2550	3650	5050	2050	3000	4300	5900	2550	3600
	5000	2800	4000	1500	2300	3350	4700	1900	2800	4000	5500	2300	3350	4700	6400	2900	4000
11,000 LB	SL	1400	2250	700	1200	1700	2650	850	1450	2000	3000	1050	1700	2350	3450	1250	1950
	1000	1500	2400	750	1300	1850	2800	950	1550	2200	3250	1150	1850	2550	3700	1400	2150
	2000	1650	2600	850	1450	2000	3000	1050	1700	2350	3500	1250	2000	2800	4000	1550	2350
	3000	1800	2750	900	1550	2200	3250	1150	1850	2600	3750	1400	2200	3050	4300	1700	2550
	4000	1950	2950	1000	1700	2400	3500	1250	2000	2850	4050	1600	2400	3350	4700	1900	2800
	5000	2150	3200	1150	1800	2600	3800	1400	2150	3100	4400	1750	2600	3650	5100	2100	3100
10,000 LB	SL	1100	1850	500	1000	1350	2150	650	1150	1550	2450	750	1350	1800	2750	900	1550
	1000	1200	2000	600	1100	1450	2300	700	1250	1700	2600	850	1450	1950	2950	1000	1650
	2000	1350	2150	650	1150	1600	2450	800	1350	1850	2800	950	1550	2150	3200	1100	1800
	3000	1450	2300	700	1250	1700	2650	850	1450	2000	3050	1050	1700	2350	3450	1250	1950
	4000	1600	2500	800	1350	1900	2850	950	1550	2200	3250	1150	1850	2600	3800	1400	2150
	5000	1750	2650	850	1450	2050	3050	1050	1700	2400	3500	1300	2000	2850	4050	1600	2400

REMARKS:
1. Take-off distances are aircraft requirements under normal service conditions.
2. Take-off Power, 3000 rpm 61 in. Hg.
3. Flaps up.

DATA AS OF 8-15-53
BASED ON FLIGHT TEST

FUEL GRADE: 100/130
FUEL DENSITY: 6.0 LB/GAL

126-93-1783

Figure A-5. Take-off Distances (Sheet 1 of 2)

WADC
Form 241G
(11 Jun 51)

TAKE-OFF DISTANCES

(FEET)

HARD-SURFACE RUNWAY

MODEL: F-51H

ENGINE (S): (1) V-1650-9

GROSS WEIGHT	PRESSURE ALTITUDE	5 DEGREES CENTIGRADE				+15 DEGREES CENTIGRADE				+35 DEGREES CENTIGRADE				+55 DEGREES CENTIGRADE			
		ZERO WIND		30 KNOT WIND		ZERO WIND		30-KNOT WIND		ZERO WIND		30 KNOT WIND		ZERO WIND		30 KNOT WIND	
		GROUND RUN	TO CLEAR 50 FT OBST.	GROUND RUN	TO CLEAR 50 FT OBST.	GROUND RUN	TO CLEAR 50 FT OBST.	GROUND RUN	TO CLEAR 50 FT OBST.	GROUND RUN	TO CLEAR 50 FT OBST.	GROUND RUN	TO CLEAR 50 FT OBST.	GROUND RUN	TO CLEAR 50 FT OBST.	GROUND RUN	TO CLEAR 50 FT OBST.
9000 LB	SL	900	1600	400	800	1050	1800	500	950	1250	2000	600	1100	1450	2300	700	1250
	1000	950	1650	400	850	1150	1900	500	1000	1350	2150	650	1150	1550	2450	750	1300
	2000	1050	1750	450	900	1250	2050	600	1100	1450	2300	700	1250	1650	2600	850	1450
	3000	1100	1900	500	1000	1350	2150	650	1200	1550	2450	800	1350	1850	2800	950	1550
	4000	1200	2000	550	1050	1450	2300	700	1250	1700	2650	850	1450	2000	3000	1050	1700
	5000	1300	2150	650	1150	1600	2500	800	1350	1850	2850	950	1600	2200	3250	1150	1850
	SL																
	1000																
	2000																
	3000																
	4000																
	5000																
	SL																
	1000																
	2000																
	3000																
	4000																
	5000																
	SL																
	1000																
	2000																
	3000																
	4000																
	5000																

REMARKS:
1. Take-off distances are aircraft requirements under normal service conditions.
2. Take-off Power, 3000 rpm 61 in. Hg.
3. Flaps up.

DATA AS OF 8-15-53
BASED ON FLIGHT TEST

126-93-1784

FUEL GRADE: 100/130
FUEL DENSITY: 6.0 LB/GAL

Figure A-5. Take-off Distances (Sheet 2 of 2)

WADC Form 2411 (11 Jan 51)

NORMAL POWER CLIMB CHART

STANDARD DAY

MODEL: F-51H

ENGINE(S): (1) V-1650-9

CONFIGURATION: SIX 5 IN. ROCKETS - PLUS TWO 165 GAL TANKS, TWO 110 GAL TANKS, TWO 75 GAL TANKS, TWO 500 LB BOMBS, OR ONE 110 GAL TANK PLUS ONE 1000 LB BOMB

GROSS WEIGHT: 12,600 TO 11,300 POUNDS

CONFIGURATION: SIX 5 IN. ROCKETS - PLUS TWO 165 GAL TANKS, TWO 110 GAL TANKS, TWO 75 GAL TANKS, TWO 500 LB BOMBS, OR ONE 110 GAL TANK PLUS ONE 1000 LB BOMB

GROSS WEIGHT: 11,300 POUNDS OR LESS

RATE OF CLIMB	APPROXIMATE FROM SEA LEVEL DISTANCE	TIME	FUEL	MP IN. Hg (2)	CAS (MPH)	PRESSURE ALTITUDE (FEET)	CAS (MPH)	MP IN. Hg (2)	APPROXIMATE FROM SEA LEVEL FUEL	TIME	DISTANCE	RATE OF CLIMB
800	0	0	15(1)	46	175	SEA LEVEL	175	46	15(1)	0	0	1000
750	20	6	25	46	185	5,000	185	46	23	5	17	900
700	44	13	35	46	190	10,000	190	46	32	11	37	850
700	71	20	47	46	190	15,000	190	46	41	17	59	850
650	102	28	60	46	185	20,000	185	46	51	23	83	850
150	154	40	79	F.T.	180	25,000	180	F.T.	65	31	121	300
200	181	71	128	46	175	30,000	175	46	91	48	195	350
50	336	103	179	F.T.	165	35,000	165	F.T.	114	62	266	250
						40,000						
						45,000						

CONFIGURATION: SIX 5 IN. ROCKETS PLUS TWO 1000 LB BOMBS

GROSS WEIGHT: 12,400 POUNDS OR LESS

CONFIGURATION:

GROSS WEIGHT:

RATE OF CLIMB	APPROXIMATE FROM SEA LEVEL DISTANCE	TIME	FUEL	MP IN. Hg (2)	CAS (MPH)	PRESSURE ALTITUDE (FEET)	CAS (MPH)	MP IN. Hg	APPROXIMATE FROM SEA LEVEL FUEL	TIME	DISTANCE	RATE OF CLIMB
750	0	0	15(1)	46	175	SEA LEVEL						
700	21	7	25	46	185	5,000						
700	46	14	37	46	190	10,000						
650	75	21	49	46	190	15,000						
600	107	30	62	46	185	20,000						
100	170	44	85	F.T.	180	25,000						
						30,000						
						35,000						
						40,000						
						45,000						

REMARKS:

1. Warm-up, taxi, and take-off allowance.
2. 2700 rpm.
3. Blower shift automatic.

LEGEND

RATE OF CLIMB - FEET PER MINUTE
DISTANCE - STATUTE MILES
TIME - MINUTES
FUEL - US. GALLONS
MP - MANIFOLD PRESSURE
CAS - CALIBRATED AIRSPEED
F.T. - FULL THROTTLE

DATA AS OF 8-15-53
BASED ON FLIGHT TEST

FUEL GRADE 100/130
FUEL DENSITY 6.0 LB/GAL

126-93-1787

Figure A-6. Normal Power Climb (Sheet 1 of 2)

WADC
Form 2411
(11 Jun 51)

NORMAL POWER CLIMB CHART

STANDARD DAY

MODEL: F-51H

ENGINE(S): (1) V-1650-9

CONFIGURATION: TWO 165 GAL TANKS, TWO 110 GAL TANKS, TWO 75 GAL TANKS, TWO 1000 LB BOMBS, TWO 500 LB BOMBS, TEN 5 IN. ROCKETS, OR ONE 110 GAL TANK PLUS ONE 1000 LB BOMB

GROSS WEIGHT: 11,800 TO 10,000 POUNDS

CONFIGURATION: TWO 165 GAL TANKS, TWO 110 GAL TANKS, TWO 75 GAL TANKS, TWO 1000 LB BOMBS, TWO 500 LB BOMBS, TEN 5 IN. ROCKETS, OR ONE 110 GAL TANK PLUS ONE 1000 LB BOMB

GROSS WEIGHT: 10,000 POUNDS OR LESS

APPROXIMATE				MP (IN Hg) (2)	CAS (MPH)	PRESSURE ALTITUDE (FEET)	CAS (MPH)	MP (IN Hg) (2)	APPROXIMATE			
RATE OF CLIMB	FROM SEA LEVEL								FROM SEA LEVEL			RATE OF CLIMB
	DISTANCE	TIME	FUEL						FUEL	TIME	DISTANCE	
1050	0	0	15(1)	46	175	SEA LEVEL	175	46	15(1)	0	0	1350
1050	15	5	22	46	185	5,000	185	46	21	4	12	1350
1000	32	10	30	46	190	10,000	130	46	27	8	25	1300
1000	51	15	38	46	190	15,000	190	46	33	11	40	1300
950	72	20	47	46	185	20,000	185	46	39	15	55	1300
450	103	27	58	F.T.	180	25,000	180	F.T.	47	20	76	700
450	154	38	76	46	175	30,000	175	46	57	26	106	800
350	207	49	93	F.T.	165	35,000	165	F.T.	67	33	136	750
						40,000	155	F.T.	79	42	182	350
						45,000						

CONFIGURATION: WING RACKS

GROSS WEIGHT: 9500 POUNDS OR LESS

CONFIGURATION:

GROSS WEIGHT:

APPROXIMATE				MP (IN Hg) (2)	CAS (MPH)	PRESSURE ALTITUDE (FEET)	CAS (MPH)	MP (IN Hg)	APPROXIMATE			
RATE OF CLIMB	FROM SEA LEVEL								FROM SEA LEVEL			RATE OF CLIMB
	DISTANCE	TIME	FUEL						FUEL	TIME	DISTANCE	
1750	0	0	15(1)	46	175	SEA LEVEL						
1750	9	3	19	46	185	5,000						
1800	19	6	24	46	190	10,000						
1850	29	8	28	46	190	15,000						
1850	41	11	33	46	185	20,000						
1200	54	14	38	F.T.	180	25,000						
1300	73	18	44	46	175	30,000						
1250	91	22	50	F.T.	165	35,000						
850	115	27	57	F.T.	155	40,000						
300	160	36	64	F.T.	140	45,000						

REMARKS:
1. Warm-up, taxi, and take-off allowance.
2. 2700 rpm.
3. Blower shift automatic.

LEGEND

RATE OF CLIMB - FEET PER MINUTE
DISTANCE - STATUTE MILES
TIME - MINUTES
FUEL - US. GALLONS
MP - MANIFOLD PRESSURE
CAS - CALIBRATED AIRSPEED
F.T. - FULL THROTTLE

DATA AS OF 8-15-53
BASED ON FLIGHT TEST

FUEL GRADE: 100/130
FUEL DENSITY 6.0 LB/GAL

126-93-1788

Figure A-6. Normal Power Climb (Sheet 2 of 2)

WADC
Form 2411
(11 Jun 51)

MILITARY POWER CLIMB CHART

STANDARD DAY

MODEL: F-51H ENGINE(S): (1) V-1650-9

CONFIGURATION: SIX 5 IN. ROCKETS - PLUS TWO 165 GAL TANKS, TWO 110 GAL TANKS, TWO 75 GAL TANKS, TWO 500 LB BOMBS, OR ONE 110 GAL TANK PLUS ONE 1000 LB BOMB GROSS WEIGHT 12,600 TO 11,300 POUNDS							CONFIGURATION: SIX 5 IN. ROCKETS - PLUS TWO 165 GAL TANKS, TWO 110 GAL TANKS, TWO 75 GAL TANKS, TWO 500 LB BOMBS, OR ONE 110 GAL TANK PLUS ONE 1000 LB BOMB GROSS WEIGHT: 11,300 POUNDS OR LESS					
APPROXIMATE				MP (IN. Hg) (2)	CAS (MPH)	PRESSURE ALTITUDE (FEET)	CAS (MPH)	MP (IN. Hg) (2)	APPROXIMATE			
RATE OF CLIMB	FROM SEA LEVEL								FROM SEA LEVEL			RATE OF CLIMB
	DISTANCE	TIME	FUEL						FUEL	TIME	DISTANCE	
1200	0	0	15[1]	61	175	SEA LEVEL	175	61	15[1]	0	0	1350
1100	14	4	26	61	185	5,000	185	61	24	4	12	1300
1050	30	9	38	61	190	10,000	190	61	34	8	26	1250
900	49	13	51	61	190	15,000	190	61	46	12	42	1100
450	79	21	70	61	185	20,000	185	61	61	18	66	600
650	119	30	95	F.T.	180	25,000	180	F.T.	80	25	96	800
600	152	38	116	61	175	30,000	175	61	96	30	122	800
300	201	48	140	F.T.	165	35,000	165	61	114	38	157	500
						40,000	155	F.T.	142	55	242	100
						45,000						

CONFIGURATION: SIX 5 IN. ROCKETS PLUS TWO 1000 LB BOMBS GROSS WEIGHT: 12,400 POUNDS OR LESS							CONFIGURATION: GROSS WEIGHT:					
APPROXIMATE				MP (IN. Hg) (2)	CAS (MPH)	PRESSURE ALTITUDE (FEET)	CAS (MPH)	MP (IN. Hg)	APPROXIMATE			
RATE OF CLIMB	FROM SEA LEVEL								FROM SEA LEVEL			RATE OF CLIMB
	DISTANCE	TIME	FUEL						FUEL	TIME	DISTANCE	
1150	0	0	15[1]	61	175	SEA LEVEL						
1050	14	5	26	61	185	5,000						
1000	31	9	39	61	190	10,000						
850	51	15	53	61	190	15,000						
400	84	23	73	61	185	20,000						
600	128	33	101	F.T.	180	25,000						
550	165	41	124	61	175	30,000						
250	222	53	153	F.T.	165	35,000						
						40,000						
						45,000						

REMARKS:
1. Warm-up, taxi, and take-off allowance.
2. 3000 rpm.
3. Hold time at Military Power to a minimum.
4. Blower shift automatic.

LEGEND

RATE OF CLIMB - FEET PER MINUTE
DISTANCE - STATUTE MILES
TIME - MINUTES
FUEL - US. GALLONS
MP - MANIFOLD PRESSURE
CAS - CALIBRATED AIRSPEED
F.T. - FULL THROTTLE

DATA AS OF 8-15-53
BASED ON FLIGHT TEST

FUEL GRADE: 100/130
FUEL DENSITY: 6.0 LB/GAL

126-93-1785

Figure A-7. Military Power Climb (Sheet 1 of 2)

WADC
Form 2411
(11 Jun 51)

MILITARY POWER CLIMB CHART

STANDARD DAY

MODEL: F-51H ENGINE(S): (1) V-1650-9

CONFIGURATION: TWO 165 GAL TANKS, TWO 110 GAL TANKS, TWO 75 GAL TANKS, TWO 1000 LB BOMBS, TWO 500 LB BOMBS, TEN 5 IN. ROCKETS, OR ONE 110 GAL TANK PLUS ONE 1000 LB BOMB GROSS WEIGHT: 11,800 TO 10,000 POUNDS							CONFIGURATION: TWO 165 GAL TANKS, TWO 110 GAL TANKS, TWO 75 GAL TANKS, TWO 1000 LB BOMBS, TWO 500 LB BOMBS, TEN 5 IN. ROCKETS, OR ONE 110 GAL TANK PLUS ONE 1000 LB BOMB GROSS WEIGHT: 10,000 POUNDS OR LESS					
APPROXIMATE				MP (IN Hg) (2)	CAS (MPH)	PRESSURE ALTITUDE (FEET)	CAS (MPH)	MP (IN Hg) (2)	APPROXIMATE			
RATE OF CLIMB	FROM SEA LEVEL								FROM SEA LEVEL			RATE OF CLIMB
	DISTANCE	TIME	FUEL						FUEL	TIME	DISTANCE	
1450	0	0	15(1)	61	175	SEA LEVEL	175	61	15(1)	0	0	1800
1400	11	3	24	61	185	5,000	185	61	22	3	9	1750
1350	24	7	33	61	190	10,000	190	61	29	6	19	1700
1250	38	11	43	61	190	15,000	190	61	37	9	31	1600
750	59	16	56	61	185	20,000	185	61	47	12	46	1050
950	84	22	72	F.T.	180	25,000	180	F.T.	59	17	64	1300
950	106	27	86	61	175	30,000	175	61	69	20	81	1300
650	136	33	101	F.T.	165	35,000	165	F.T.	79	25	101	1000
100	204	46	124	F.T.	155	40,000	155	F.T.	90	31	133	540
						45,000						

CONFIGURATION: WING RACKS GROSS WEIGHT: 9500 POUNDS OR LESS							CONFIGURATION: GROSS WEIGHT					
APPROXIMATE				MP (IN. Hg) (2)	CAS (MPH)	PRESSURE ALTITUDE (FEET)	CAS (MPH)	MP (IN. Hg)	APPROXIMATE			
RATE OF CLIMB	FROM SEA LEVEL								FROM SEA LEVEL			RATE OF CLIMB
	DISTANCE	TIME	FUEL						FUEL	TIME	DISTANCE	
2250	0	0	15(1)	61	175	SEA LEVEL						
2250	7	2	20	61	185	5,000						
2250	15	4	26	61	190	10,000						
2150	24	7	32	61	190	15,000						
1600	35	9	39	61	185	20,000						
1900	47	12	47	F.T.	180	25,000						
1900	59	15	55	61	175	30,000						
1600	72	18	62	F.T.	165	35,000						
1100	91	21	68	F.T.	155	40,000						
500	123	28	73	F.T.	140	45,000						

REMARKS:
1. Warm-up, taxi, and take-off allowance.
2. 3000 rpm.
3. Hold time at Military Power to a minimum.
4. Blower shift automatic.

LEGEND
RATE OF CLIMB - FEET PER MINUTE
DISTANCE - STATUTE MILES
TIME - MINUTES
FUEL - US. GALLONS
MP - MANIFOLD PRESSURE
CAS - CALIBRATED AIRSPEED
F.T. - FULL THROTTLE

DATA AS OF 8-15-53
BASED ON FLIGHT TEST

FUEL GRADE 100/130
FUEL DENSITY 6.0 LB/GAL

126-93-1786

Figure A-7. Military Power Climb (Sheet 2 of 2)

WADC
Form 241G
(11 Jun 51)

LANDING DISTANCES

(FEET)

STANDARD DAY

MODEL- F-51H ENGINE(S)- (1) V-1650-9

GROSS WEIGHT (LB)	BEST IAS FOR APPROACH		HARD-SURFACE - NO WIND							
	POWER ON	POWER OFF	AT SEA LEVEL		AT 2000 FT		AT 4000 FT		AT 6000 FT	
	(MPH)	(MPH)	GROUND ROLL	TO CLEAR 50 FT OBST	GROUND ROLL	TO CLEAR 50 FT OBST	GROUND ROLL	TO CLEAR 50 FT OBST	GROUND ROLL	TO CLEAR 50 FT OBST
10,000	NOT AVAILABLE	140	1150	2000	1200	2050	1300	2150	1400	2250
9,000		140	1000	1850	1050	1900	1150	2000	1200	2050
8,000		140	850	1650	950	1750	1050	1850	1100	1900

REMARKS: 1. Landing distances are airplane requirements under normal service conditions.
2. Flaps full down.

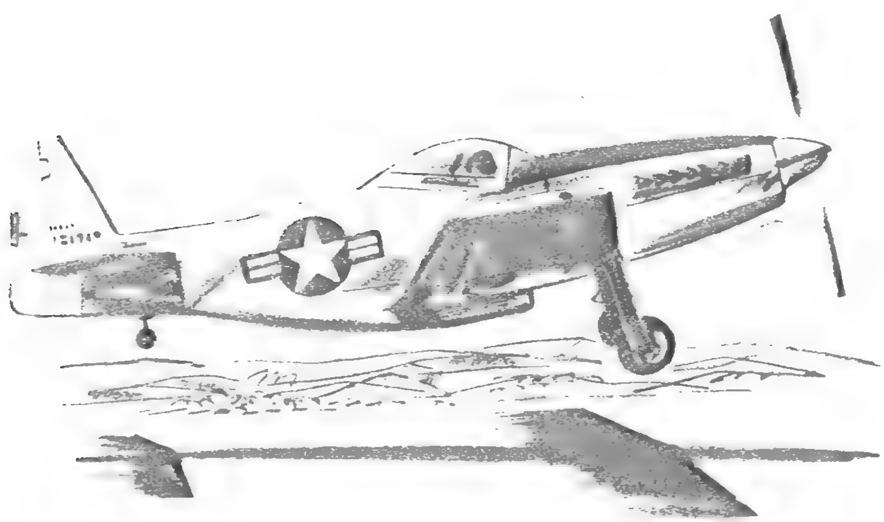
LEGEND
IAS - INDICATED AIRSPEED
OBST. - OBSTACLE

DATA AS OF 8-1-53
BASED ON FLIGHT TEST

126-93-1791

FUEL GRADE 100/130
FUEL DENSITY 6.0 LB/GAL

Figure A-8. Landing Distances



COMBAT ALLOWANCE CHART

MILITARY POWER

STANDARD DAY

MODEL: F-51H ENGINE(S): (1) V-1650-9

PRESSURE ALTITUDE (FEET)	RPM	MP (IN Hg)	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT (MIN)	LIMIT COOLANT TEMP(°C)	FUEL FLOW (GPM)
SEA LEVEL	3000	61	LOW	RUN	15	125	3.0
2,000	3000	61	LOW	RUN	15	125	3.0
4,000	3000	61	LOW	RUN	15	125	3.0
6,000	3000	61	LOW	RUN	15	125	3.0
8,000	3000	61	LOW	RUN	15	125	3.0
10,000	3000	61	LOW	RUN	15	125	3.0
12,000	3000	61	LOW	RUN	15	125	3.0
14,000	3000	61	LOW	RUN	15	125	3.0
16,000	3000	61	LOW	RUN	15	125	3.0
18,000	3000	61	LOW	RUN	15	125	3.0
20,000	3000	61	LOW	RUN	15	125	3.0
22,000	3000	F.T.	LOW	RUN	15	125	2.5
24,000	3000	F.T.	LOW	RUN	15	125	2.5
26,000	3000	61	HIGH	RUN	15	125	2.5
28,000	3000	61	HIGH	RUN	15	125	2.5
30,000	3000	61	HIGH	RUN	15	125	2.5
32,000	3000	F.T.	HIGH	RUN	15	125	2.5
34,000	3000	F.T.	HIGH	RUN	15	125	2.5
36,000	3000	F.T.	HIGH	RUN	15	125	2.0
38,000	3000	F.T.	HIGH	RUN	15	125	2.0
40,000	3000	F.T.	HIGH	RUN	15	125	1.5

REMARKS:

1. F.T. = Full throttle.
2. Blower shift automatic.

DATA AS OF 9-17-45
BASED ON FLIGHT TEST

FUEL GRADE 100/130
FUEL DENSITY 6.0 LB/GAL

126-93-1782

Figure A-9. Combat Allowance

WADC Form 241U (11 Jun 51)

MAXIMUM ENDURANCE CHART

STANDARD DAY

MODEL: F-51H

ENGINE(S): (1) V-1650-9

CONFIGURATION: SIX 5 IN. ROCKETS - PLUS TWO 165 GAL TANKS, TWO 110 GAL TANKS, TWO 75 GAL TANKS, TWO 500 LB BOMBS, OR ONE 110 GAL TANK PLUS ONE 1000 LB BOMB GROSS WEIGHT: 12,600 TO 11,300 POUNDS							CONFIGURATION: SIX 5 IN. ROCKETS - PLUS TWO 165 GAL TANKS, TWO 110 GAL TANKS, TWO 75 GAL TANKS, TWO 500 LB BOMBS, OR ONE 110 GAL TANK PLUS ONE 1000 LB BOMB GROSS WEIGHT: 11,300 POUNDS OR LESS			
APPROXIMATE				CAS (MPH)	PRESSURE ALTITUDE (FEET)	CAS (MPH)	APPROXIMATE			
GPH	MIXTURE	RPM	MP (IN Hg)				MP (IN Hg)	RPM	MIXTURE	GPH
48	RUN	1700	33	145	SEA LEVEL	135	29	1700	RUN	45
51	RUN	1700	34	145	5,000	135	30	1700	RUN	47
45	RUN	1750	34	145	10,000	135	32	1700	RUN	50
60	RUN	2000	32	145	15,000	135	30	1900	RUN	54
65	RUN	2150	32	145	20,000	135	30	2100	RUN	59
71	RUN	2200	37	145	25,000	135	34	2150	RUN	64
					30,000	135	35	2350	RUN	67
					35,000					
					40,000					
					45,000					

CONFIGURATION: SIX 5 IN. ROCKETS PLUS TWO 1000 LB BOMBS GROSS WEIGHT: 12,400 POUNDS OR LESS							CONFIGURATION: GROSS WEIGHT:			
APPROXIMATE				CAS (MPH)	PRESSURE ALTITUDE (FEET)	CAS (MPH)	APPROXIMATE			
GPH	MIXTURE	RPM	MP (IN Hg)				MP (IN Hg)	RPM	MIXTURE	GPH
46	RUN	1700	31	140	SEA LEVEL					
49	RUN	1700	32	140	5,000					
53	RUN	1750	33	140	10,000					
57	RUN	1950	31	140	15,000					
62	RUN	2100	31	140	20,000					
67	RUN	2150	36	140	25,000					
					30,000					
					35,000					
					40,000					
					45,000					

REMARKS:

1. Use high blower for altitudes below heavy line.

LEGEND
GPH - FUEL CONSUMPTION
CAS - CALIBRATED AIRSPEED

DATA AS OF 8-15-53
BASED ON FLIGHT TEST

FUEL GRADE 100/130
FUEL DENSITY 6.0 LB/GAL

126-93-1789

Figure A-10. Maximum Endurance (Sheet 1 of 2)

WADC
Form 241U
(11 Jun 51)

MAXIMUM ENDURANCE CHART

STANDARD DAY

MODEL: F-51H ENGINE(S): (1) V-1650-9

CONFIGURATION: TWO 165 GAL TANKS, TWO 110 GAL TANKS, TWO 75 GAL TANKS, TWO 1000 LB BOMBS, TWO 500 LB BOMBS, TEN 5 IN. ROCKETS, OR ONE 110 GAL TANK PLUS ONE 1000 LB BOMB
GROSS WEIGHT: 11,800 TO 10,000 POUNDS

CONFIGURATION: TWO 165 GAL TANKS, TWO 110 GAL TANKS, TWO 75 GAL TANKS, TWO 1000 LB BOMBS, TWO 500 LB BOMBS, TEN 5 IN. ROCKETS, OR ONE 110 GAL TANK PLUS ONE 1000 LB BOMB
GROSS WEIGHT: 10,000 POUNDS OR LESS

APPROXIMATE				CAS (MPH)	PRESSURE ALTITUDE (FEET)	CAS (MPH)	APPROXIMATE			
GPH	MIXTURE	RPM	MP (IN Hg)				MP (IN Hg)	RPM	MIXTURE	GPH
44	RUN	1700	28	145	SEA LEVEL	140	23	1700	RUN	40
47	RUN	1700	29	145	5,000	140	24	1700	RUN	42
50	RUN	1700	31	145	10,000	140	25	1700	RUN	44
53	RUN	1900	29	145	15,000	140	27	1750	RUN	47
58	RUN	2050	29	145	20,000	140	26	1950	RUN	50
63	RUN	2100	34	145	25,000	140	30	2000	RUN	55
					30,000	140	30	2200	RUN	61
					35,000					
					40,000					
					45,000					

CONFIGURATION: WING RACKS
GROSS WEIGHT: 9500 POUNDS OR LESS

CONFIGURATION:
GROSS WEIGHT:

APPROXIMATE				CAS (MPH)	PRESSURE ALTITUDE (FEET)	CAS (MPH)	APPROXIMATE			
GPH	MIXTURE	RPM	MP (IN Hg)				MP (IN Hg)	RPM	MIXTURE	GPH
38	RUN	1700	20	145	SEA LEVEL					
40	RUN	1700	21	145	5,000					
41	RUN	1700	21	145	10,000					
43	RUN	1700	24	145	15,000					
46	RUN	1900	24	145	20,000					
50	RUN	2000	25	145	25,000					
55	RUN	2100	26	145	30,000					
60	RUN	2300	28	145	35,000					
					40,000					
					45,000					

REMARKS:

1. Use high blower for altitudes below heavy line.

LEGEND
GPH - FUEL CONSUMPTION
CAS - CALIBRATED AIRSPEED

DATA AS OF 8-15-53
BASED ON FLIGHT TEST

FUEL GRADE 100/130
FUEL DENSITY 6.0 LB/GAL

128-93-1790

Figure A-10. Maximum Endurance (Sheet 2 of 2)

WADC Form 241K (11 Jun 51)

AIRCRAFT MODEL (S)

F-51H

ENGINE(S): (1) V 1650-9

FLIGHT OPERATION INSTRUCTION CHART

STANDARD DAY

CHART WEIGHT LIMITS: 11,800 TO 10,000 POUNDS

EXTERNAL LOAD ITEMS

TWO 165 GAL DROP TANKS, TWO 110 GAL DROP TANKS, TWO 75 GAL DROP TANKS, ONE 110 GAL DROP TANK PLUS ONE 1000 LB BOMB, TWO 1000 LB BOMBS, TWO 500 LB BOMBS, OR 10 ROCKETS

LIMITS	RPM	MP IN HG	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	COOLANT TEMP	TOTAL GPH
WAR EMER(2)	3000 3000	67 67	LOW HIGH	RUN RUN	5 MIN	135°C 135°C	210 180
MILITARY POWER	3000 3000	61 61	LOW HIGH	RUN RUN	15 MIN	125°C 125°C	180 150

INSTRUCTIONS FOR USING CHART: Select figure in FUEL column equal to or less than amount of fuel to be used for cruising(1). Move horizontally to right or left and select RANGE value equal to or greater than the statute or nautical air miles to be flown. Vertically below and opposite value nearest desired cruising altitude (ALT), read rpm, manifold pressure (MP), and MIXTURE setting required. Refer to corresponding column and altitude for new power settings when gross weight falls below limits of this chart

NOTES: Column I is for emergency high-speed cruising only. Columns II, III, IV, and V give progressive increase in range at a sacrifice in speed. Air miles per gallon (MI/GAL) (no wind), gallons per hr (GPH), and true airspeed (TAS) are approximate values for reference. Range values are for an average airplane flying alone (no wind)(1).

COLUMN I		FUEL(1)	COLUMN II		COLUMN III		COLUMN IV		FUEL(1)	COLUMN V	
RANGE IN AIR MILES		US. GAL	RANGE IN AIR MILES		RANGE IN AIR MILES		RANGE IN AIR MILES		US. GAL	RANGE IN AIR MILES	
STATUTE	NAUTICAL		STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL		STATUTE	NAUTICAL
			SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING(1)								
1765	1530	580	1955	1700	2205	1915	2420	2100	580	2630	2280
1645	1430	540	1815	1575	2045	1775	2245	1950	540	2440	2120
1520	1320	500	1680	1460	1890	1640	2070	1795	500	2245	1950
1400	1215	460	1540	1340	1730	1500	1895	1645	460	2055	1780
1280	1110	420	1405	1220	1575	1365	1720	1495	420	1865	1620
1155	1000	380	1265	1100	1415	1230	1540	1335	380	1670	1450
1035	900	340	1130	980	1255	1090	1365	1185	340	1480	1285
915	795	300	990	860	1100	955	1190	1030	300	1290	1120
790	685	260	860	745	950	825	1030	895	260	1120	970
670	580	220	725	630	805	700	870	755	220	945	820

MAXIMUM CONTINUOUS						PRESS ALT	(3.30 STAT. (2.86 NAUT.) MI/GAL)						(3.66 STAT. (3.18 NAUT.) MI/GAL)						(3.97 STAT. (3.45 NAUT.) MI/GAL)						PRESS. ALT	MAXIMUM AIR RANGE					
RPM	MP IN.	MIX TURE	TOTAL GPH	APPROX TAS MPH	KN	FEET	RPM	MP IN.	MIX TURE	TOTAL GPH	APPROX TAS MPH	KN	RPM	MP IN.	MIX TURE	TOTAL GPH	APPROX TAS MPH	KN	RPM	MP IN.	MIX TURE	TOTAL GPH	APPROX TAS MPH	KN	FEET	RPM	MP IN.	MIX TURE	TOTAL GPH	APPROX TAS MPH	KN
						40,000																			40,000						
						35,000																			35,000						
SEE COLUMN III						30,000							2700	46.0	RUN	98	373	324	2500	43.0	RUN	91	366	318	30,000	2400	39.0	RUN	81	346	300
SEE COLUMN III						25,000							2700	46.0	RUN	97	361	314	2550	43.5	RUN	89	355	308	25,000	2250	40.5	RUN	78	336	292
SEE COLUMN III						20,000							2700	46.0	RUN	100	367	319	2500	43.0	RUN	88	350	304	20,000	2250	36.5	RUN	72	307	267
SEE COLUMN II						15,000	2700	46.0	RUN	100	348	302	2600	44.0	RUN	92	337	293	2250	40.0	RUN	79	310	269	15,000	2000	32.0	RUN	60	258	224
SEE COLUMN II						10,000	2700	46.0	RUN	99	327	284	2450	42.5	RUN	84	308	268	2050	38.5	RUN	69	280	243	10,000	SEE COLUMN IV					
2700	46	RUN	97	308	267	5,000	2600	44.5	RUN	91	302	262	2300	41.0	RUN	76	281	244	2000	38.0	RUN	64	255	221	5,000	SEE COLUMN IV					
2700	46	RUN	95	287	249	SL	2500	43.0	RUN	84	277	240	2150	39.5	RUN	69	256	221	1850	36.5	RUN	56	226	196	SL	SEE COLUMN IV					

SPECIAL NOTES

(1) Make allowance for warm-up, take-off, and climb plus allowance for wind, reserve, and combat as required.
(2) See figure A-6 for wet operation. High blower above heavy line.

REVISED 2-20-47
DATA AS OF 10-1-45
BASED ON: FLIGHT TEST

EXAMPLE

At 11,000 lb gross weight with 500 gal of fuel (after deducting total allowances of 30 gal) to fly 2070 stat. air miles at 10,000 ft altitude, maintain 2050 rpm and 38.5 in. manifold pressure with mixture set: RUN. When gross weight reaches 10,000 lb, use sheet 2, column IV.

F-51H-1-93-3

LEGEND

ALT - PRESSURE ALTITUDE
MP - MANIFOLD PRESSURE
GPH - US. GALLONS PER HOUR
TAS - TRUE AIRSPEED
KN - KNOTS
SL - SEA LEVEL
F.T. - FULL THROTTLE

FUEL GRADE: 100/130

FUEL DENSITY: 6.0 LB/GAL

Figure A-11. Flight Operation Instruction Chart—11,800 to 7600 Pounds (Sheet 1 of 2)

WADC Form 241K (11 Jun 51)

AIRCRAFT MODEL (S)

F-51H

ENGINE(S): (1) V-1650-9

FLIGHT OPERATION INSTRUCTION CHART

STANDARD DAY

CHART WEIGHT LIMITS: 10,000 TO 7600 POUNDS

EXTERNAL LOAD ITEMS

TWO 165 GAL DROP TANKS, TWO 110 GAL DROP TANKS, TWO 75 GAL DROP TANKS, ONE 110 GAL DROP TANK PLUS ONE 1000 LB BOMB, TWO 1000 LB BOMBS, TWO 500 LB BOMBS, OR 10 ROCKETS

LIMITS	RPM	MP IN HG	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	COOLANT TEMP	TOTAL GPH
WAR EMER(2)	3000 3000	67 67	LOW HIGH	RUN RUN	5 MIN	135°C 135°C	210 180
MILITARY POWER	3000 3000	61 61	LOW HIGH	RUN RUN	15 MIN	125°C 125°C	180 150

INSTRUCTIONS FOR USING CHART: Select figure in FUEL column equal to or less than amount of fuel to be used for cruising(1). Move horizontally to right or left and select RANGE value equal to or greater than the statute or nautical air miles to be flown. Vertically below and opposite value nearest desired cruising altitude (ALT), read rpm, manifold pressure (MP), and MIXTURE setting required. Refer to corresponding column and altitude for new power settings when gross weight falls below limits of this chart.

NOTES: Column I is for emergency high-speed cruising only. Columns II, III, IV, and V give progressive increase in range at a sacrifice in speed. Air miles per gallon (MI/GAL) (no wind), gallons per hr (GPH), and true airspeed (TAS) are approximate values for reference. Range values are for an average airplane flying alone (no wind)(1).

COLUMN I		FUEL(1) US. GAL	COLUMN II		COLUMN III		COLUMN IV		FUEL(1) US. GAL	COLUMN V	
RANGE IN AIR MILES			RANGE IN AIR MILES		RANGE IN AIR MILES		RANGE IN AIR MILES			RANGE IN AIR MILES	
STATUTE	NAUTICAL		STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL		STATUTE	NAUTICAL
			SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING(1)								
1215	1055	400	1375	1195	1580	1370	1760	1530	400	1910	1660
1095	950	360	1240	1075	1420	1230	1585	1375	360	1720	1495
970	840	320	1100	955	1265	1100	1410	1220	320	1530	1330
850	740	280	965	840	1110	965	1230	1070	280	1340	1160
730	635	240	825	715	950	825	1055	915	240	1145	995
610	530	200	690	600	790	685	880	765	200	955	830
485	420	160	550	475	630	545	705	610	160	765	665
365	315	120	410	355	475	410	525	455	120	575	500
245	210	80	275	240	315	275	350	305	80	380	330
120	105	40	140	120	160	140	175	150	40	190	165

MAXIMUM CONTINUOUS						PRESS ALT FEET	(3.44 STAT. (2.99 NAUT.) MI/GAL)						(3.95 STAT. (3.43 NAUT.) MI/GAL)						(4.40 STAT. (3.82 NAUT.) MI/GAL)						PRESS ALT FEET	MAXIMUM AIR RANGE					
RPM	MP IN.	MIXTURE	TOTAL GPH	APPROX TAS MPH	APPROX TAS KN		RPM	MP IN.	MIXTURE	TOTAL GPH	APPROX TAS MPH	APPROX TAS KN	RPM	MP IN.	MIXTURE	TOTAL GPH	APPROX TAS MPH	APPROX TAS KN	RPM	MP IN.	MIXTURE	TOTAL GPH	APPROX TAS MPH	APPROX TAS KN		RPM	MP IN.	MIXTURE	TOTAL GPH	APPROX TAS MPH	APPROX TAS KN
						40,000																			40,000						
						35,000																			35,000						
	SEE COLUMN III					30,000							2700	46.0	RUN	98	387	336	2400	40.5	RUN	84	371	322	30,000	2350	36.0	RUN	73	349	303
	SEE COLUMN II					25,000	2700	46.0	RUN	97	367	319	2600	44.0	RUN	92	364	316	2250	40.5	RUN	78	348	302	25,000	2150	36.0	RUN	67	323	280
	SEE COLUMN II					20,000	2700	46.0	RUN	100	370	321	2600	43.5	RUN	91	361	313	2300	38.0	RUN	75	330	286	20,000	2100	29.5	RUN	59	285	247
	SEE COLUMN II					15,000	2700	46.0	RUN	100	350	304	2350	41.0	RUN	82	329	286	2100	35.5	RUN	67	297	258	15,000	1850	29.0	RUN	52	249	216
2700	46	RUN	99	330	286	10,000	2650	45.0	RUN	95	326	283	2250	40.0	RUN	76	301	261	1850	35.5	RUN	60	265	230	10,000		SEE COLUMN IV				
2700	46	RUN	97	309	268	5,000	2550	43.5	RUN	87	300	260	2100	39.0	RUN	69	274	238	1750	35.5	RUN	54	239	207	5,000		SEE COLUMN IV				
2700	46	RUN	95	289	251	SL	2400	42.5	RUN	80	276	240	2000	38.0	RUN	63	250	217	1700	32.5	RUN	48	210	182	SL		SEE COLUMN IV				

SPECIAL NOTES

(1) Make allowance for warm-up, take-off, and climb plus allowance for wind, reserve, and combat as required.
(2) See figure A-6 for wet operation. High blower above heavy line.

EXAMPLE

At 9500 lb gross weight with 200 gal of fuel (after deducting total allowances of 30 gal) to fly 1230 stat. air miles at 15,000 ft altitude, maintain 2100 rpm and 35.5 in. manifold pressure with mixture set: RUN.

LEGEND

ALT - PRESSURE ALTITUDE
MP - MANIFOLD PRESSURE
GPH - US. GALLONS PER HOUR
TAS - TRUE AIRSPEED
KN - KNOTS
SL - SEA LEVEL
F.T. - FULL THROTTLE

REVISED 2-20-47
DATA AS OF: 10-1-46
BASED ON: FLIGHT TEST

F-51H-1-93-4

FUEL GRADE: 100/130

FUEL DENSITY: 6.0 LB/GAL

Figure A-11. Flight Operation Instruction Chart—11,800 to 7600 Pounds (Sheet 2 of 2)

WADC Form 241K (11 Jun 51)

FLIGHT OPERATION INSTRUCTION CHART

AIRCRAFT MODEL (S): F-51H

ENGINE(S): (1) V-1650-9

STANDARD DAY

CHART WEIGHT LIMITS: 12,600 TO 11,300 POUNDS

EXTERNAL LOAD ITEMS

SIX ROCKETS PLUS TWO 165 GAL DROP TANKS, SIX ROCKETS PLUS TWO 110 GAL DROP TANKS, SIX ROCKETS PLUS TWO 75 GAL DROP TANKS, SIX ROCKETS PLUS TWO 500 LB BOMBS, OR SIX ROCKETS PLUS ONE 110 GAL DROP TANK AND ONE 1000 LB BOMB

LIMITS	RPM	MP IN HG	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	COOLANT TEMP	TOTAL GPH
WAR EMER(2)	3000 3000	67 67	LOW HIGH	RUN RUN	5 MIN	135°C 135°C	210 180
MILITARY POWER	3000 3000	61 61	LOW HIGH	RUN RUN	15 MIN	125°C 125°C	180 150

INSTRUCTIONS FOR USING CHART: Select figure in FUEL column equal to or less than amount of fuel to be used for cruising(1). Move horizontally to right or left and select RANGE value equal to or greater than the statute or nautical air miles to be flown. Vertically below and opposite value nearest desired cruising altitude (ALT), read rpm, manifold pressure (MP), and MIXTURE setting required. Refer to corresponding column and altitude for new power settings when gross weight falls below limits of this chart.

NOTES: Column I is for emergency high-speed cruising only. Columns II, III, IV, and V give progressive increase in range at a sacrifice in speed. Air miles per gallon (MI/GAL) (no wind), gallons per hr (GPH), and true airspeed (TAS) are approximate values for reference. Range values are for an average airplane flying alone (no wind)(1).

COLUMN I		FUEL(1) US. GAL	COLUMN II		COLUMN III		COLUMN IV		FUEL(1) US. GAL	COLUMN V	
RANGE IN AIR MILES			RANGE IN AIR MILES		RANGE IN AIR MILES		RANGE IN AIR MILES			RANGE IN AIR MILES	
STATUTE	NAUTICAL		STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL		STATUTE	NAUTICAL
				SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING(1)							
1605	1395	580	1825	1585	2005	1740	2145	1860	580	2305	2000
1495	1300	540	1695	1470	1865	1620	1995	1730	540	2140	1860
1385	1200	500	1565	1360	1725	1500	1845	1600	500	1980	1720
1275	1105	460	1440	1250	1585	1375	1695	1470	460	1815	1575
1165	1010	420	1310	1140	1440	1250	1545	1340	420	1650	1430
1050	910	380	1185	1030	1300	1130	1395	1210	380	1490	1295
940	815	340	1065	915	1160	1005	1245	1080	340	1325	1150

MAXIMUM CONTINUOUS						PRESS ALT FEET	(3.07 STAT. (2.67 NAUT.) MI/GAL)						(3.36 STAT. (2.92 NAUT.) MI/GAL)						(3.62 STAT. (3.14 NAUT.) MI/GAL)						PRESS. ALT FEET	MAXIMUM AIR RANGE					
RPM	MP IN.	MIX-TURE	APPROX TOTAL GPH	TAS MPH	TAS KN		RPM	MP IN.	MIX-TURE	APPROX TOTAL GPH	TAS MPH	TAS KN	RPM	MP IN.	MIX-TURE	APPROX TOTAL GPH	TAS MPH	TAS KN	RPM	MP IN.	MIX-TURE	APPROX TOTAL GPH	TAS MPH	TAS KN		RPM	MP IN.	MIX-TURE	APPROX TOTAL GPH	TAS MPH	TAS KN
						40,000																			40,000						
						35,000																			35,000						
						30,000																			30,000						
	SEE COLUMN II					25,000	2700	46.0	RUN	97	327	284							2500	43.0	RUN	88	320	278	25,000	2350	41.0	RUN	81	308	267
	SEE COLUMN II					20,000	2700	46.0	RUN	100	335	291	2700	45.5	RUN	97	334	290	2550	43.0	RUN	89	323	281	20,000	2400	40.5	RUN	80	305	265
	SEE COLUMN II					15,000	2700	46.0	RUN	100	321	279	2600	44.0	RUN	92	311	270	2300	41.0	RUN	80	292	254	15,000	2100	34.5	RUN	66	250	217
	SEE COLUMN II					10,000	2700	46.0	RUN	99	307	267	2500	43.0	RUN	99	289	251	2100	39.0	RUN	72	259	225	10,000			SEE COLUMN IV			
2700	46	RUN	97	282	245	5,000	2600	44.5	RUN	91	277	241	2250	40.5	RUN	75	256	222	1950	37.5	RUN	63	229	199	5,000			SEE COLUMN IV			
2700	46	RUN	95	265	230	SL	2500	43.0	RUN	84	255	221	2150	39.5	RUN	69	232	202	1800	36.0	RUN	54	195	169	SL			SEE COLUMN IV			

SPECIAL NOTES

(1) Make allowance for warm-up, take-off, and climb plus allowance for wind, reserve, and combat as required.
(2) See figure A-6 for wet operation. High blower above heavy line.

EXAMPLE

At 12,000 lb gross weight with 500 gal of fuel (after deducting total allowances of 30 gal) to fly 1980 stat. air miles at 15,000 ft altitude, maintain 2100 rpm and 34.5 in. manifold pressure with mixture set: RUN. When gross weight reaches 11,300 lb, use sheet 2, column V.

LEGEND

ALT - PRESSURE ALTITUDE
MP - MANIFOLD PRESSURE
GPH - US. GALLONS PER HOUR
TAS - TRUE AIRSPEED
KN - KNOTS
SL - SEA LEVEL
F.T. - FULL THROTTLE

REVISED 2-20-47
DATA AS OF: 10-1-45
BASED ON: FLIGHT TEST

F-51H-1-93-5

FUEL GRADE: 100/130

FUEL DENSITY: 6.0 LB/GAL

Figure A-12. Flight Operation Instruction Chart—12,600 to 8400 Pounds (Sheet 1 of 2)

WADC Form 241K (11 Jun 51)

AIRCRAFT MODEL (S): F-51H

ENGINE(S): (1) V-1650-9

FLIGHT OPERATION INSTRUCTION CHART

STANDARD DAY

CHART WEIGHT LIMITS: 11,300 TO 8400 POUNDS

EXTERNAL LOAD ITEMS
SIX ROCKETS PLUS TWO 165 GAL DROP TANKS, SIX ROCKETS PLUS TWO 110 GAL DROP TANKS, SIX ROCKETS PLUS TWO 75 GAL DROP TANKS, SIX ROCKETS PLUS TWO 500 LB BOMBS, OR SIX ROCKETS PLUS ONE 110 GAL DROP TANK AND ONE 1000 LB BOMB

LIMITS	RPM	MP IN HG	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	COOLANT TEMP	TOTAL GPH
WAR EMER(2)	3000	67	LOW	RUN	5 MIN	135°C	210
	3000	67	HIGH	RUN		135°C	180
MILITARY POWER	3000	61	LOW	RUN	15 MIN	125°C	160
	3000	61	HIGH	RUN		125°C	160

INSTRUCTIONS FOR USING CHART: Select figure in FUEL column equal to or less than amount of fuel to be used for cruising(1) Move horizontally to right or left and select RANGE value equal to or greater than the statute or nautical air miles to be flown. Vertically below and opposite value nearest desired cruising altitude (ALT), read rpm, manifold pressure (MP), and MIXTURE setting required. Refer to corresponding column and altitude for new power settings when gross weight falls below limits of this chart.

NOTES: Column I is for emergency high-speed cruising only. Columns II, III, IV, and V give progressive increase in range at a sacrifice in speed. Air miles per gallon (MI/GAL) (no wind), gallons per hr (GPH), and true airspeed (TAS) are approximate values for reference. Range values are for an average airplane flying alone (no wind)(1).

SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING(1)

COLUMN I Statute	COLUMN I Nautical	FUEL(1) US. GAL	COLUMN II Statute	COLUMN II Nautical	COLUMN III Statute	COLUMN III Nautical	COLUMN IV Statute	COLUMN IV Nautical	FUEL(1) US. GAL	COLUMN V Statute	COLUMN V Nautical
1330	1155	480	1530	1330	1685	1460	1800	1560	480	1960	1700
1220	1060	440	1400	1215	1545	1340	1650	1430	440	1800	1560
1110	965	400	1270	1100	1405	1220	1500	1300	400	1635	1420
995	865	360	1145	995	1265	1100	1350	1170	360	1470	1275
885	770	320	1020	885	1125	975	1200	1040	320	1310	1135
775	675	280	890	770	985	855	1050	910	280	1145	995
665	575	240	765	665	845	735	900	780	240	980	850
555	480	200	635	550	705	610	750	650	200	815	705
445	385	160	510	440	560	485	600	520	160	655	570
330	285	120	380	330	420	365	450	390	120	490	425
220	190	80	255	220	280	245	300	260	80	325	280
110	95	40	125	110	140	120	150	130	40	165	145
MAXIMUM CONTINUOUS		PRESS ALT	(3.18 STAT. (2.76 NAUT.) MI/GAL)		(3.51 STAT. (3.05 NAUT.) MI/GAL)		(3.75 STAT. (3.26 NAUT.) MI/GAL)		PRESS. ALT	MAXIMUM AIR RANGE	

Columns I and II (APPROX TOTAL GPH and TAS):

PRESS ALT FEET	I RPM	I MP IN.	I MIXTURE	I TOTAL GPH	I TAS MPH	I TAS KN	II RPM	II MP IN.	II MIXTURE	II TOTAL GPH	II TAS MPH	II TAS KN
40,000												
35,000												
30,000		SEE COLUMN III										
25,000		SEE COLUMN II					2700	46.0	RUN	97	331	288
20,000		SEE COLUMN II					2700	46.0	RUN	100	337	293
15,000		SEE COLUMN II					2700	46.0	RUN	100	318	276
10,000	2700	46	RUN	99	300	260	2650	44.5	RUN	93	295	256
5,000	2700	46	RUN	97	281	244	2500	43.0	RUN	85	270	234
SL	2700	46	RUN	95	262	227	2350	41.5	RUN	77	246	214

Columns III, IV and V (APPROX TOTAL GPH and TAS):

PRESS ALT FEET	III RPM	III MP IN.	III MIXTURE	III TOTAL GPH	III TAS MPH	III TAS KN	IV RPM	IV MP IN.	IV MIXTURE	IV TOTAL GPH	IV TAS MPH	IV TAS KN	V RPM	V MP IN.	V MIXTURE	V TOTAL GPH	V TAS MPH	V TAS KN
40,000																		
35,000																		
30,000	2700	46.0	RUN	98	346	300	2450	43.0	RUN	88	336	292	2400	37.5	RUN	77	313	272
25,000	2650	45.0	RUN	94	330	286	2400	42.5	RUN	85	320	278	2200	38.0	RUN	72	295	250
20,000	2650	44.5	RUN	95	332	288	2400	41.5	RUN	82	312	271	2150	31.0	RUN	62	254	220
15,000	2400	41.5	RUN	84	298	259	2150	38.5	RUN	73	276	240		SEE COLUMN IV				
10,000	2250	40.5	RUN	77	272	236	1950	37.0	RUN	65	244	212		SEE COLUMN IV				
5,000	2150	39.0	RUN	70	247	214	1850	36.5	RUN	58	221	192		SEE COLUMN IV				
SL	2000	38.0	RUN	63	221	192	1700	35.0	RUN	50	189	164		SEE COLUMN IV				

SPECIAL NOTES

(1) Make allowance for warm-up, take-off, and climb plus allowance for wind, reserve, and combat as required.
(2) See figure A-6 for wet operation. High blower above heavy line.

EXAMPLE

At 10,000 lb gross weight with 400 gal of fuel (after deducting total allowances of 50 gal) to fly 1500 stat. air miles at 10,000 ft altitude, maintain 1950 rpm and 37 in. manifold pressure with mixture set: RUN.

LEGEND

ALT - PRESSURE ALTITUDE
MP - MANIFOLD PRESSURE
GPH - US. GALLONS PER HOUR
TAS - TRUE AIRSPEED
KN - KNOTS
SL - SEA LEVEL
F.T. - FULL THROTTLE

REVISED 2-20-47
DATA AS OF: 10-1-45
BASED ON: FLIGHT TEST

F-51H-1-93-6

FUEL GRADE: 100/130 FUEL DENSITY 6.0 LB/GAL

Figure A-12. Flight Operation Instruction Chart—12,600 to 8400 Pounds (Sheet 2 of 2)

WADC Form 241K (11 Jun 51)

AIRCRAFT MODEL (S)

F-51H

ENGINE(S): (1) V-1650-9

FLIGHT OPERATION INSTRUCTION CHART

STANDARD DAY

CHART WEIGHT LIMITS: 12,400 TO 10,300 POUNDS

EXTERNAL LOAD ITEMS

SIX ROCKETS PLUS TWO 1000 LB BOMBS

LIMITS	RPM	MP IN HG	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	COOLANT TEMP	TOTAL GPH
WAR EMER(2)	3000 3000	67 67	LOW HIGH	RUN RUN	5 MIN	135°C 135°C	210 180
MILITARY POWER	3000 3000	61 61	LOW HIGH	RUN RUN	15 MIN	125°C 125°C	180 150

INSTRUCTIONS FOR USING CHART: Select figure in FUEL column equal to or less than amount of fuel to be used for cruising(1). Move horizontally to right or left and select RANGE value equal to or greater than the statute or nautical air miles to be flown. Vertically below and opposite value nearest desired cruising altitude (ALT), read rpm, manifold pressure (MP), and MIXTURE setting required. Refer to corresponding column and altitude for new power settings when gross weight falls below limits of this chart.

NOTES: Column I is for emergency high-speed cruising only. Columns II, III, IV, and V give progressive increase in range at a sacrifice in speed. Air miles per gallon (MI/GAL) (no wind), gallons per hr (GPH), and true airspeed (TAS) are approximate values for reference. Range values are for an average airplane flying alone (no wind)(1).

COLUMN I RANGE IN AIR MILES STATUTE	COLUMN I NAUTICAL	FUEL(1) US. GAL	COLUMN II STATUTE	COLUMN II NAUTICAL	COLUMN III STATUTE	COLUMN III NAUTICAL	COLUMN IV STATUTE	COLUMN IV NAUTICAL	FUEL(1) US. GAL	COLUMN V STATUTE	COLUMN V NAUTICAL
			SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING(1)								
680	590	250	735	640	810	705	885	770	250	925	805
570	495	210	620	540	680	590	745	645	210	780	675
460	400	170	500	435	550	475	605	525	170	630	545
350	305	130	380	330	420	365	460	400	130	480	415
245	210	90	265	230	290	250	320	280	90	335	290
135	115	50	145	125	160	140	180	155	50	185	160

MAXIMUM CONTINUOUS RPM	MP IN.	MIXTURE	TOTAL GPH	TAS MPH	TAS KN	PRESS. ALT FEET	(2.95 STAT. (2.56 NAUT.) MI/GAL) RPM	MP IN.	MIXTURE	TOTAL GPH	TAS MPH	TAS KN	(3.23 STAT. (2.80 NAUT.) MI/GAL) RPM	MP IN.	MIXTURE	TOTAL GPH	TAS MPH	TAS KN	(3.55 STAT. (3.08 NAUT.) MI/GAL) RPM	MP IN.	MIXTURE	TOTAL GPH	TAS MPH	TAS KN	PRESS. ALT FEET	MAXIMUM AIR RANGE RPM	MP IN.	MIXTURE	TOTAL GPH	TAS MPH	TAS KN
						40,000																			40,000						
						35,000																			35,000						
						30,000																			30,000						
SEE COLUMN III						25,000							2700	46.0	RUN	87	321	278	2500	43.0	RUN	88	314	273	25,000	2350	41.0	RUN	81	302	262
SEE COLUMN III						20,000							2700	46.0	RUN	100	328	285	2500	43.0	RUN	88	313	272	20,000	2350	40.0	RUN	79	293	254
SEE COLUMN II						15,000	2700	46	RUN	100	310	269	2600	44.0	RUN	92	302	262	2250	40.0	RUN	79	281	244	15,000	2100	35.5	RUN	67	249	216
SEE COLUMN II						10,000	2700	46	RUN	99	293	264	2400	42.5	RUN	84	275	239	2050	38.5	RUN	69	247	214	10,000	SEE COLUMN IV					
2700	46	RUN	97	274	238	5,000	2600	44	RUN	89	267	232	2200	40.0	RUN	74	246	214	1950	37.5	RUN	63	220	191	5,000	SEE COLUMN IV					
2700	46	RUN	95	256	222	SL	2400	42	RUN	79	242	210	2100	39.0	RUN	69	222	193	1800	35.5	RUN	53	188	163	SL	SEE COLUMN IV					

SPECIAL NOTES

(1) Make allowance for warm-up, take-off, and climb plus allowance for wind, reserve, and combat as required.
(2) See figure A-6 for wet operation. High blower above heavy line.

EXAMPLE

At 11,000 lb gross weight with 210 gal of fuel (after deducting total allowances of 40 gal) to fly 885 stat. air miles at 10,000 ft altitude, maintain 2050 rpm and 38.5 in. manifold pressure with mixture set: RUN.

LEGEND

ALT - PRESSURE ALTITUDE
MP - MANIFOLD PRESSURE
GPH - US. GALLONS PER HOUR
TAS - TRUE AIRSPEED
KN - KNOTS
SL - SEA LEVEL
F.T. - FULL THROTTLE

REVISED 2-25-47
DATA AS OF: 10-1-45
BASED ON: FLIGHT TEST

F-51H-1-93-7

FUEL GRADE: 100/130

FUEL DENSITY: 6.0 LB/GAL

Figure A-13. Flight Operation Instruction Chart—12,400 to 10,300 Pounds

WADC Form 241K (11 Jun 51)

AIRCRAFT MODEL (S)

F-51H

ENGINE(S): (1) V-1650-9

FLIGHT OPERATION INSTRUCTION CHART

STANDARD DAY

CHART WEIGHT LIMITS: 9500 TO 7400 POUNDS

EXTERNAL LOAD ITEMS

WING RACKS

LIMITS	RPM	MP IN HG	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	COOLANT TEMP	TOTAL GPH
WAR EMER(2)	3000	67	LOW	RUN	5 MIN	135°C	210
	3000	67	HIGH	RUN		135°C	180
MILITARY POWER	3000	61	LOW	RUN	15 MIN	125°C	180
	3000	61	HIGH	RUN		125°C	150

INSTRUCTIONS FOR USING CHART: Select figure in FUEL column equal to or less than amount of fuel to be used for cruising(1). Move horizontally to right or left and select RANGE value equal to or greater than the statute or nautical air miles to be flown. Vertically below and opposite value nearest desired cruising altitude (ALT), read rpm, manifold pressure (MP) and MIXTURE setting required. Refer to corresponding column and altitude for new power settings when gross weight falls below limits of this chart.

NOTES: Column I is for emergency high-speed cruising only. Columns II, III, IV, and V give progressive increase in range at a sacrifice in speed. Air miles per gallon (MI/GAL) (no wind), gallons per hr (GPH), and true airspeed (TAS) are approximate values for reference. Range values are for an average airplane flying alone (no wind)(1).

COLUMN I		FUEL(1) US. GAL	COLUMN II		COLUMN III		COLUMN IV		FUEL(1) US. GAL	COLUMN V	
RANGE IN AIR MILES			RANGE IN AIR MILES		RANGE IN AIR MILES		RANGE IN AIR MILES			RANGE IN AIR MILES	
STATUTE	NAUTICAL		STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL		STATUTE	NAUTICAL
			SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING(1)								
815	710	250	955	830	1090	945	1220	1060	250	1300	1130
685	595	210	805	700	915	795	1025	890	210	1090	945
555	480	170	650	565	740	645	830	720	170	885	770
425	370	130	500	435	565	490	635	550	130	675	585
295	255	90	345	300	390	340	440	380	90	470	410
165	145	50	190	165	220	190	245	210	50	260	225

MAXIMUM CONTINUOUS						PRESS	(3.83 STAT. (3.32 NAUT.) MI/GAL)						(4.35 STAT. (3.78 NAUT.) MI/GAL)						(4.76 STAT. (4.14 NAUT.) MI/GAL)						PRESS	MAXIMUM AIR RANGE					
			APPROX			ALT				APPROX						APPROX						APPROX			ALT				APPROX		
				TAS							TAS						TAS						TAS							TAS	
RPM	MP IN.	MIXTURE	TOTAL GPH	MPH	KN	FEET	RPM	MP IN.	MIXTURE	TOTAL GPH	MPH	KN	RPM	MP IN.	MIXTURE	TOTAL GPH	MPH	KN	RPM	MP IN.	MIXTURE	TOTAL GPH	MPH	KN	FEET	RPM	MP IN.	MIXTURE	TOTAL GPH	MPH	KN
						40,000																			40,000						
SEE COLUMN II						35,000	2700	46.0	RUN	98	422	367	2600	44.0	RUN	95	420	365	2500	40.5	RUN	84	407	353	35,000	2400	35.0	RUN	74	387	336
SEE COLUMN II						30,000	2700	46.0	RUN	98	411	357	2600	44.0	RUN	94	408	355	2400	40.0	RUN	82	392	340	30,000	2350	35.0	RUN	71	369	320
SEE COLUMN II						25,000	2700	46.0	RUN	97	392	340	2500	43.0	RUN	88	336	335	2250	40.0	RUN	76	367	319	25,000	2150	35.0	RUN	65	341	296
SEE COLUMN II						20,000	2700	46.0	RUN	100	396	344	2450	42.0	RUN	85	375	326	2250	37.0	RUN	73	345	300	20,000	2100	29.5	RUN	59	308	268
2700	46	RUN	100	372	323	15,000	2650	45.0	RUN	96	368	320	2200	39.5	RUN	77	341	296	2050	34.0	RUN	65	312	271	15,000	1850	28.5	RUN	50	262	227
2700	46	RUN	99	351	305	10,000	2550	43.5	RUN	89	342	297	2150	39.0	RUN	72	314	273	1850	35.0	RUN	58	281	244	10,000	SEE COLUMN IV					
2700	46	RUN	97	329	286	5,000	2400	42.5	RUN	82	315	273	2000	38.0	RUN	65	286	248	1700	35.0	RUN	53	252	219	5,000	SEE COLUMN IV					
2700	46	RUN	95	308	268	SL	2300	41.0	RUN	76	289	251	1950	37.0	RUN	60	261	227	1700	29.5	RUN	45	217	188	SL	SEE COLUMN IV					

SPECIAL NOTES

(1) Make allowance for warm-up, take-off, and climb plus allowance for wind, reserve, and combat as required.
(2) See figure A-6 for wet operation. High blower above heavy line.

EXAMPLE

At 9000 lb gross weight with 210 gal of fuel (after deducting total allowances of 45 gal) to fly 915 stat. air miles at 10,000 ft altitude, maintain 2150 rpm and 39 in. manifold pressure with mixture set: RUN.

LEGEND

ALT - PRESSURE ALTITUDE
MP - MANIFOLD PRESSURE
GPH - US. GALLONS PER HOUR
TAS - TRUE AIRSPEED
KN - KNOTS
SL - SEA LEVEL
F.T. - FULL THROTTLE

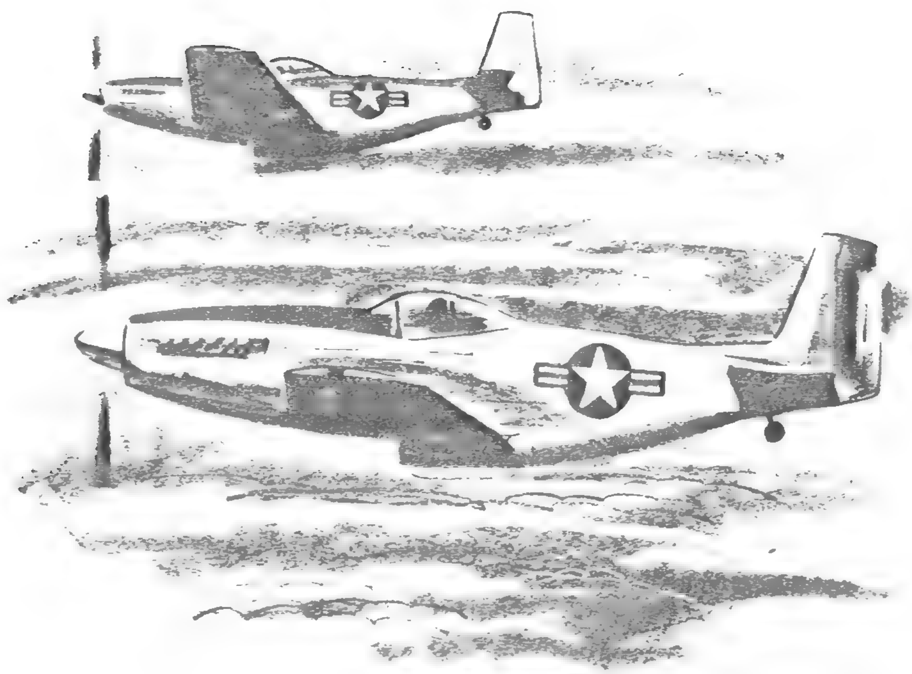
REVISED 2-25-47
DATA AS OF: 9-17-45
BASED ON: FLIGHT TEST

F-51H-1-93-2

FUEL GRADE: 100/130

FUEL DENSITY: 6.0 LB/GAL

Figure A-14. Flight Operation Instruction Chart—9500 to 7400 Pounds



Index

PAGE NUMBERS IN BOLDFACE DENOTE ILLUSTRATIONS

PAGE NUMBERS IN BOLDFACE DENOTE ILLUSTRATIONS

PAGE NUMBERS IN BOLDFACE DENOTE ILLUSTRATIONS

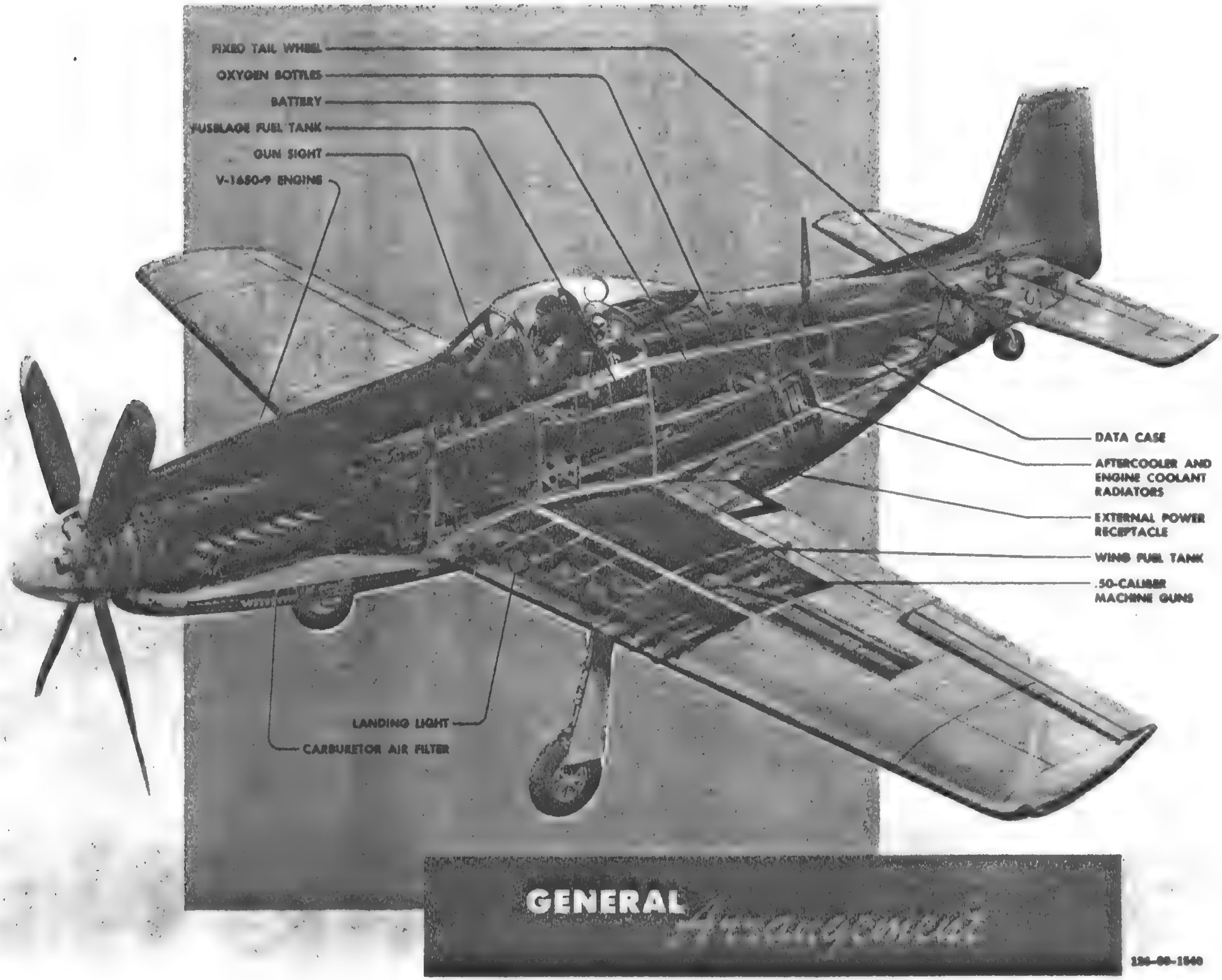
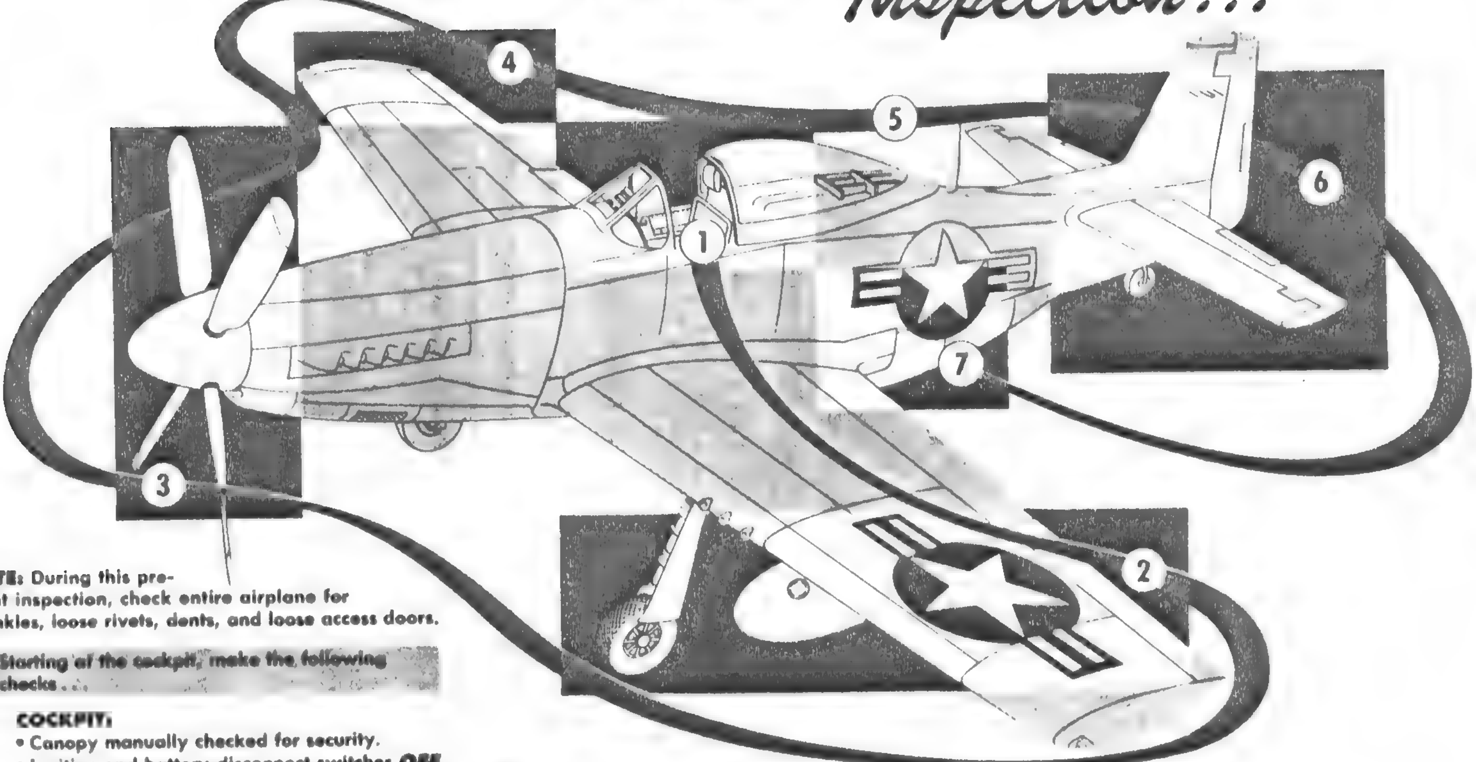

FIXED TAIL WHEEL
OXYGEN BOTTLES
BATTERY
FUSELAGE FUEL TANK
GUN SIGHT
V-1650-9 ENGINE
DATA CASE
AFTERCOOLER AND ENGINE COOLANT RADIATORS
EXTERNAL POWER RECEPTACLE
WING FUEL TANK
.50-CALIBER MACHINE GUNS
LANDING LIGHT
CARBURETOR AIR FILTER
GENERAL Arrangement

Figure 1-3

EXTERIOR *Inspection...*



NOTE: During this preflight inspection, check entire airplane for wrinkles, loose rivets, dents, and loose access doors.

Starting at the cockpit, make the following checks . . .

1. **COCKPIT:**
   - Canopy manually checked for security.
   - Ignition and battery-disconnect switches ***OFF.***
   - Check Form 1 for status of airplane and servicing.
   - Trim tabs neutral.
   - Compare flap handle position with wing flap position.
2. **LEFT WING SECTION:**
   - Condition of wing flaps, trailing edge, and control surface.
   - Wing tip and position light.
   - Leading edge and gun bay doors secure.
   - Wheel well for leaks, gear assembly, downlocks, and strut inflation 2 inches.
   - Tire for inflation, wear, and slippage on wheel
   - Drop tank fuel level, cap secure.
   - Fuel tank level, cap secure.
   - Landing light.
   - Wheels chocked.
3. **ENGINE SECTION:**
   - Cowl for security.
   - Exhaust stack plugs removed.
   - Air scoops for obstructions.
   - Propeller for nicks and excessive oil.
4. **RIGHT WING SECTION:**
   - Tire for inflation, wear, and slippage on wheel.
   - Wheel well for leaks, gear assembly, downlocks, and strut inflation 2 inches.
   - Leading edge and gun bay doors secure.
   - Fuel tank level, cap secure.
   - Drop tank fuel level, cap secure.
   - Pitot cover removed, check for obstructions.
   - Wing tip and position light.
   - Condition of control surface, trailing edge, and wing flaps.
5. **RIGHT FUSELAGE SECTION:**
   - Coolant flap for condition and position.
   - Static pressure vent clean.
   - Radio antenna for security.
6. **TAIL SECTION:**
   - Surfaces and controls for condition.
   - Position light.
   - Trim tab position.
   - Tail wheel tire for damage, slippage, and inflation of strut.
7. **LEFT FUSELAGE SECTION:**
   - Static pressure vent clean.
   - Fuel cap secure.

136-00-1546

Figure 2-2

Approach AND LANDING PROCEDURE

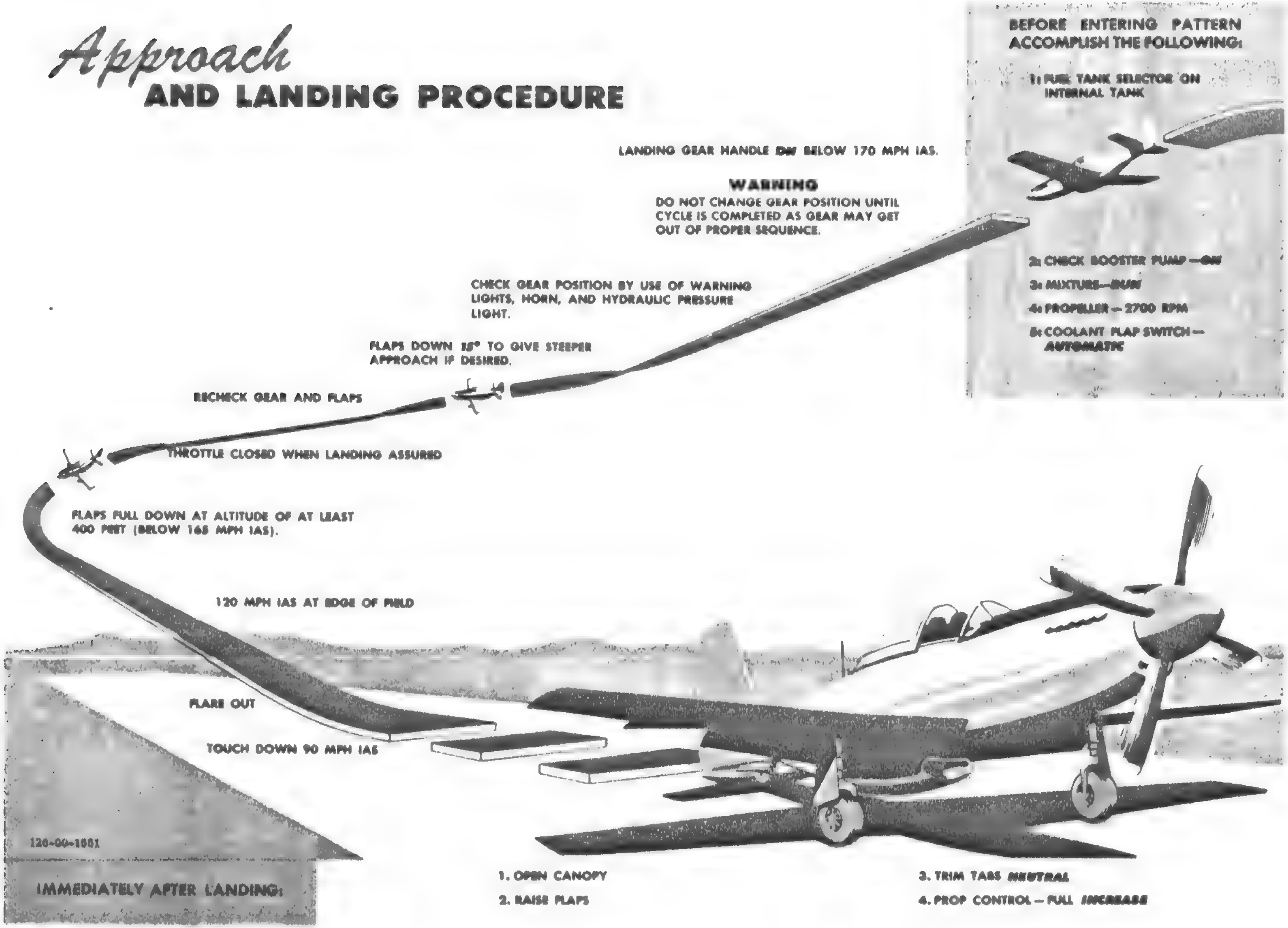


Figure 2-4

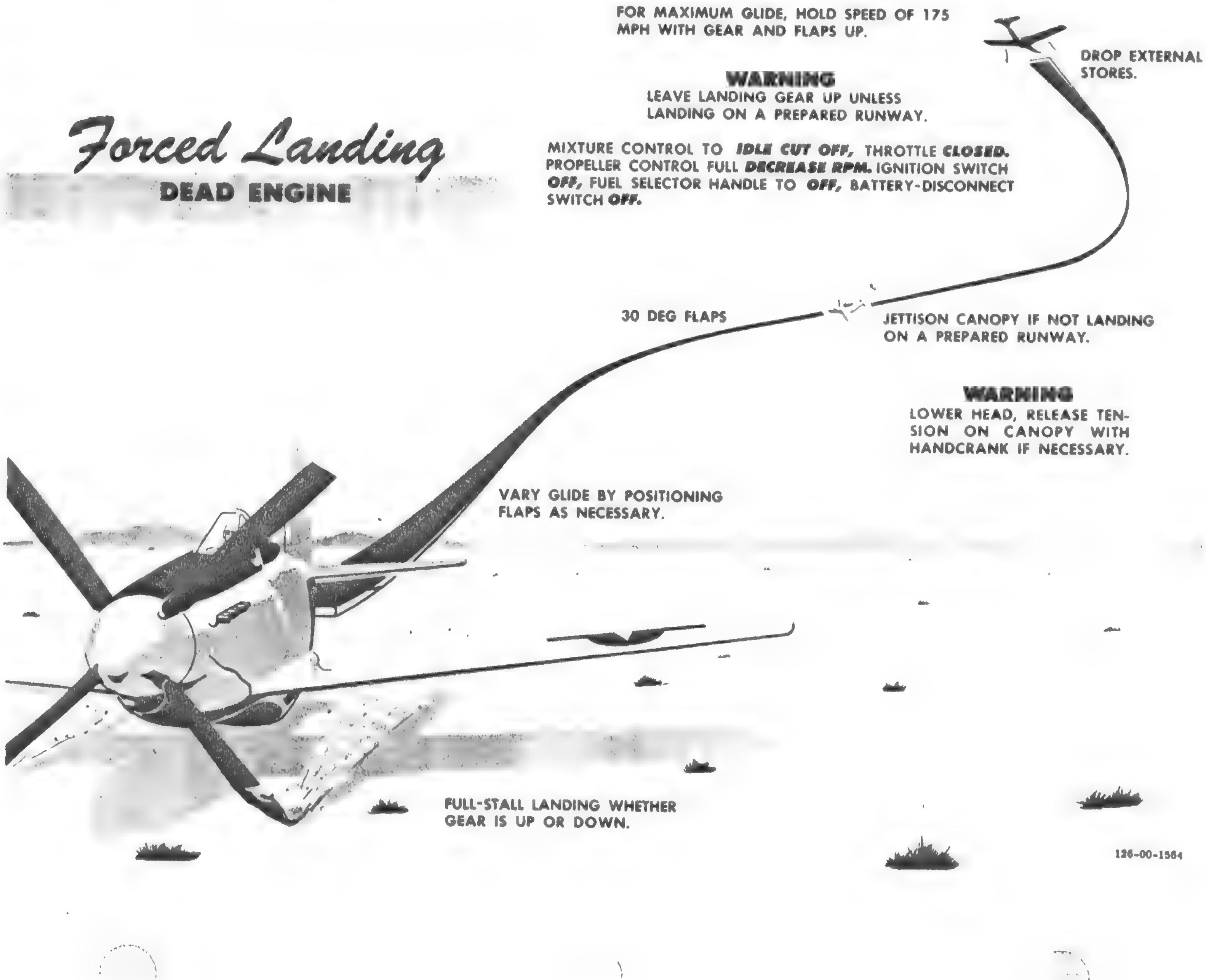

Forced Landing
DEAD ENGINE
FOR MAXIMUM GLIDE, HOLD SPEED OF 175 MPH WITH GEAR AND FLAPS UP.
DROP EXTERNAL STORES.
WARNING
LEAVE LANDING GEAR UP UNLESS LANDING ON A PREPARED RUNWAY.
MIXTURE CONTROL TO IDLE CUT OFF, THROTTLE CLOSED. PROPELLER CONTROL FULL DECREASE RPM. IGNITION SWITCH OFF, FUEL SELECTOR HANDLE TO OFF, BATTERY-DISCONNECT SWITCH OFF.
30 DEG FLAPS
JETTISON CANOPY IF NOT LANDING ON A PREPARED RUNWAY.
WARNING
LOWER HEAD, RELEASE TENSION ON CANOPY WITH HANDCRANK IF NECESSARY.
VARY GLIDE BY POSITIONING FLAPS AS NECESSARY.
FULL-STALL LANDING WHETHER GEAR IS UP OR DOWN.
126-00-1564

Figure 3-3

WADC
Form 241G
(11 Jun 51)

TAKE-OFF DISTANCES

(FEET)

HARD-SURFACE RUNWAY

MODEL: F-51H

ENGINE (S): (1) V-1650-9

GROSS WEIGHT	PRESSURE ALTITUDE	-5 DEGREES CENTIGRADE				+15 DEGREES CENTIGRADE				+35 DEGREES CENTIGRADE				+55 DEGREES CENTIGRADE			
		ZERO WIND		30-KNOT WIND		ZERO WIND		30-KNOT WIND		ZERO WIND		30-KNOT WIND		ZERO WIND		30-KNOT WIND	
		GROUND RUN	TO CLEAR 50 FT OBST.	GROUND RUN	TO CLEAR 50 FT OBST.	GROUND RUN	TO CLEAR 50 FT OBST.	GROUND RUN	TO CLEAR 50 FT OBST.	GROUND RUN	TO CLEAR 50 FT OBST.	GROUND RUN	TO CLEAR 50 FT OBST.	GROUND RUN	TO CLEAR 50 FT OBST.	GROUND RUN	TO CLEAR 50 FT OBST.
13,000 LB	SL	2100	3150	1100	1800	2600	3700	1400	2150	3100	4350	1700	2550	3600	5050	2050	3050
	1000	2300	3400	1250	1950	2800	4000	1550	2350	3350	4650	1900	2800	3950	5450	2300	3350
	2000	2500	3650	1350	2150	3050	4350	1700	2600	3700	5100	2100	3100	4350	5950	2600	3650
	3000	2750	3950	1500	2300	3350	4750	1900	2850	4050	5550	2400	3400	4800	6550	2900	4050
	4000	3000	4300	1700	2500	3700	5150	2150	3100	4450	6050	2650	3800	5350	7200	3200	4500
	5000	3300	4650	1850	2750	4100	5600	2400	3450	4900	6650	3000	4200	5900	7950	3650	5150
12,000 LB	SL	1750	2700	900	1500	2100	3150	1100	1750	2500	3600	1300	2100	2900	4150	1600	2450
	1000	1900	2900	1000	1650	2300	3400	1200	1900	2750	3900	1500	2300	3200	4500	1750	2650
	2000	2100	3150	1100	1750	2500	3650	1350	2100	3000	4250	1650	2500	3550	4900	2000	2950
	3000	2300	3400	1200	1900	2750	3950	1500	2300	3300	4650	1850	2750	3900	5400	2250	3250
	4000	2550	3700	1350	2100	3050	4300	1700	2550	3650	5050	2050	3000	4300	5900	2550	3600
	5000	2800	4000	1500	2300	3350	4700	1900	2800	4000	5500	2300	3350	4700	6400	2900	4000
11,000 LB	SL	1400	2250	700	1200	1700	2650	850	1450	2000	3000	1050	1700	2350	3450	1250	1950
	1000	1500	2400	750	1300	1850	2800	950	1550	2200	3250	1150	1850	2550	3700	1400	2150
	2000	1650	2600	850	1450	2000	3000	1050	1700	2350	3500	1250	2000	2800	4000	1550	2350
	3000	1800	2750	900	1550	2200	3250	1150	1850	2600	3750	1400	2200	3050	4300	1700	2550
	4000	1950	2950	1000	1700	2400	3500	1250	2000	2850	4050	1600	2400	3350	4700	1900	2800
	5000	2150	3200	1150	1800	2600	3800	1400	2150	3100	4400	1750	2600	3650	5100	2100	3100
10,000 LB	SL	1100	1650	500	1000	1350	2150	650	1150	1550	2450	750	1350	1800	2750	900	1550
	1000	1200	2000	600	1100	1450	2300	700	1250	1700	2600	850	1450	1950	2950	1000	1650
	2000	1350	2150	650	1150	1600	2450	800	1350	1850	2800	950	1550	2150	3200	1100	1800
	3000	1450	2300	700	1250	1700	2650	850	1450	2000	3050	1050	1700	2350	3450	1250	1950
	4000	1600	2500	800	1350	1900	2850	950	1550	2200	3250	1150	1850	2600	3800	1400	2150
	5000	1750	2650	850	1450	2050	3050	1050	1700	2400	3500	1300	2000	2850	4050	1600	2400

REMARKS:
1. Take-off distances are aircraft requirements under normal service conditions.
2. Take-off Power, 3000 rpm 61 in. Hg.
3. Flaps up.

DATA AS OF 8-15-53
BASED ON FLIGHT TEST

FUEL GRADE: 100/130
FUEL DENSITY: 6.0 LB/GAL

126-93-1783

Figure A-5. Take-off Distances (Sheet 1 of 2)

WADC Form 241G (11 Jun 51)

TAKE-OFF DISTANCES

(FEET)

HARD-SURFACE RUNWAY

MODEL: F-51H

ENGINE (S): (1) V-1650-9

GROSS WEIGHT	PRESSURE ALTITUDE	5 DEGREES CENTIGRADE				+15 DEGREES CENTIGRADE				+35 DEGREES CENTIGRADE				+55 DEGREES CENTIGRADE			
		ZERO WIND		30 KNOT WIND		ZERO WIND		30 KNOT WIND		ZERO WIND		30 KNOT WIND		ZERO WIND		30 KNOT WIND	
		GROUND RUN	TO CLEAR 50 FT OBST.	GROUND RUN	TO CLEAR 50 FT OBST.	GROUND RUN	TO CLEAR 50 FT OBST.	GROUND RUN	TO CLEAR 50 FT OBST.	GROUND RUN	TO CLEAR 50 FT OBST.	GROUND RUN	TO CLEAR 50 FT OBST.	GROUND RUN	TO CLEAR 50 FT OBST.	GROUND RUN	TO CLEAR 50 FT OBST.
9000 LB	SL	900	1600	400	800	1050	1800	500	950	1250	2000	600	1100	1450	2300	700	1250
	1000	950	1650	400	850	1150	1900	500	1000	1350	2150	650	1150	1550	2450	750	1300
	2000	1050	1750	450	900	1250	2050	600	1100	1450	2300	700	1250	1650	2600	850	1450
	3000	1100	1900	500	1000	1350	2150	650	1200	1550	2450	800	1350	1850	2800	950	1550
	4000	1200	2000	550	1050	1450	2300	700	1250	1700	2650	850	1450	2000	3000	1050	1700
	5000	1300	2150	650	1150	1600	2500	800	1350	1850	2850	950	1600	2200	3250	1150	1850
	SL																
	1000																
	2000																
	3000																
	4000																
	5000																
	SL																
	1000																
	2000																
	3000																
	4000																
	5000																
	SL																
	1000																
	2000																
	3000																
	4000																
	5000																

REMARKS:
1. Take-off distances are aircraft requirements under normal service conditions.
2. Take-off Power, 3000 rpm 61 in. Hg.
3. Flaps up.

DATA AS OF 8-15-53
BASED ON FLIGHT TEST

FUEL GRADE: 100/130
FUEL DENSITY: 6.0 LB/GAL

126-93-1784

Figure A-5. Take-off Distances (Sheet 2 of 2)

WADC Form 241K (11 Jun 51)

AIRCRAFT MODEL (S) F-51H
ENGINE(S): (1) V-1650-9

FLIGHT OPERATION INSTRUCTION CHART

STANDARD DAY

CHART WEIGHT LIMITS: 11,800 TO 10,000 POUNDS

EXTERNAL LOAD ITEMS
TWO 165 GAL DROP TANKS, TWO 110 GAL DROP TANKS, TWO 75 GAL DROP TANKS, ONE 110 GAL DROP TANK PLUS ONE 1000 LB BOMB, TWO 1000 LB BOMBS, TWO 500 LB BOMBS, OR 10 ROCKETS

LIMITS	RPM	MP IN. HG	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	COOLANT TEMP	TOTAL GPH
WAR EMER (2)	3000	67	LOW	RUN	5 MIN	135°C	210
	3000	67	HIGH	RUN		135°C	180
MILITARY POWER	3000	61	LOW	RUN	15 MIN	125°C	180
	3000	61	HIGH	RUN		125°C	150

INSTRUCTIONS FOR USING CHART: Select figure in FUEL column equal to or less than amount of fuel to be used for cruising(1). Move horizontally to right or left and select RANGE value equal to or greater than the statute or nautical air miles to be flown. Vertically below and opposite value nearest desired cruising altitude (ALT), read rpm, manifold pressure (MP), and MIXTURE setting required. Refer to corresponding column and altitude for new power settings when gross weight falls below limits of this chart.

NOTES: Column I is for emergency high-speed cruising only. Columns II, III, IV, and V give progressive increase in range at a sacrifice in speed. Air miles per gallon (MI/GAL) (no wind), gallons per hr (GPH), and true airspeed (TAS) are approximate values for reference. Range values are for an average airplane flying alone (no wind)(1).

SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING(1)

COLUMN I RANGE IN AIR MILES STATUTE	COLUMN I NAUTICAL	FUEL(1) US. GAL	COLUMN II RANGE IN AIR MILES STATUTE	COLUMN II NAUTICAL	COLUMN III RANGE IN AIR MILES STATUTE	COLUMN III NAUTICAL	COLUMN IV RANGE IN AIR MILES STATUTE	COLUMN IV NAUTICAL	FUEL(1) US. GAL	COLUMN V RANGE IN AIR MILES STATUTE	COLUMN V NAUTICAL
1765	1530	580	1955	1700	2205	1915	2420	2100	580	2630	2280
1645	1430	540	1815	1575	2045	1775	2245	1950	540	2440	2120
1520	1320	500	1680	1460	1890	1640	2070	1795	500	2245	1950
1400	1215	460	1540	1340	1730	1500	1895	1645	460	2055	1780
1280	1110	420	1405	1220	1575	1365	1720	1495	420	1865	1620
1155	1000	380	1265	1100	1415	1230	1540	1335	380	1670	1450
1035	900	340	1130	980	1255	1090	1365	1185	340	1480	1285
915	795	300	990	860	1100	955	1190	1030	300	1290	1120
790	685	260	860	745	950	825	1030	895	260	1120	970
670	580	220	725	630	805	700	870	755	220	945	820

MAXIMUM CONTINUOUS RPM	MP IN.	MIXTURE	APPROX TOTAL GPH	TAS MPH	TAS KN	PRESS ALT FEET	(3.30 STAT. (2.86 NAUT.) MI/GAL) RPM	MP IN.	MIXTURE	APPROX TOTAL GPH	TAS MPH	TAS KN	(3.66 STAT. (3.18 NAUT.) MI/GAL) RPM	MP IN.	MIXTURE	APPROX TOTAL GPH	TAS MPH	TAS KN
						40,000												
						35,000												
	SEE COLUMN III					30,000							2700	46.0	RUN	98	373	324
	SEE COLUMN III					25,000							2700	46.0	RUN	97	361	314
	SEE COLUMN III					20,000							2700	46.0	RUN	100	367	319
	SEE COLUMN II					15,000	2700	46.0	RUN	100	348	302	2600	44.0	RUN	92	337	293
	SEE COLUMN II					10,000	2700	46.0	RUN	99	327	284	2450	42.5	RUN	84	308	268
2700	46	RUN	97	308	267	5,000	2600	44.5	RUN	91	302	262	2300	41.0	RUN	76	281	244
2700	46	RUN	95	287	249	SL	2500	43.0	RUN	84	277	240	2150	39.5	RUN	69	255	221

PRESS ALT FEET	(3.97 STAT. (3.45 NAUT.) MI/GAL) RPM	MP IN.	MIXTURE	APPROX TOTAL GPH	TAS MPH	TAS KN	MAXIMUM AIR RANGE RPM	MP IN.	MIXTURE	APPROX TOTAL GPH	TAS MPH	TAS KN
40,000												
35,000												
30,000	2500	43.0	RUN	91	366	318	2400	39.0	RUN	81	346	300
25,000	2550	43.5	RUN	89	355	308	2250	40.5	RUN	76	336	292
20,000	2500	43.0	RUN	88	350	304	2250	36.5	RUN	72	307	267
15,000	2250	40.0	RUN	79	310	269	2000	32.0	RUN	60	258	224
10,000	2050	38.5	RUN	69	280	243		SEE COLUMN IV				
5,000	2000	38.0	RUN	64	255	221		SEE COLUMN IV				
SL	1850	36.5	RUN	56	226	196		SEE COLUMN IV				

SPECIAL NOTES

(1) Make allowance for warm-up, take-off, and climb plus allowance for wind, reserve, and combat as required.
(2) See figure A-6 for wet operation. High blower above heavy line.

EXAMPLE

At 11,000 lb gross weight with 500 gal of fuel (after deducting total allowances of 30 gal) to fly 2070 stat. air miles at 10,000 ft altitude, maintain 2050 rpm and 38.5 in. manifold pressure with mixture set: RUN. When gross weight reaches 10,000 lb, use sheet 2, column IV.

LEGEND

ALT - PRESSURE ALTITUDE
MP - MANIFOLD PRESSURE
GPH - US. GALLONS PER HOUR
TAS - TRUE AIRSPEED
KN - KNOTS
SL - SEA LEVEL
F.T. - FULL THROTTLE

REVISED 2-20-47
DATA AS OF 10-1-45
BASED ON: FLIGHT TEST

F-51H-1-93-3

FUEL GRADE: 100/130 FUEL DENSITY 6.0 LB/GAL

Figure A-11. Flight Operation Instruction Chart—11,800 to 7600 Pounds (Sheet 1 of 2)

WADC Form 241K (11 Jun 51)	AIRCRAFT MODEL (S)	FLIGHT OPERATION INSTRUCTION CHART	EXTERNAL LOAD ITEMS
	F-51H ENGINE(S): (1) V-1650-9	STANDARD DAY CHART WEIGHT LIMITS: 10,000 TO 7600 POUNDS	TWO 165 GAL DROP TANKS, TWO 110 GAL DROP TANKS, TWO 75 GAL DROP TANKS, ONE 110 GAL DROP TANK PLUS ONE 1000 LB BOMB, TWO 1000 LB BOMBS, TWO 500 LB BOMBS, OR 10 ROCKETS

LIMITS	RPM	MP IN HG	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	COOLANT TEMP	TOTAL GPH
WAR EMER(2)	3000	67	LOW	RUN	5 MIN	135°C	210
	3000	67	HIGH	RUN		135°C	180
MILITARY POWER	3000	61	LOW	RUN	15 MIN	125°C	180
	3000	61	HIGH	RUN		125°C	150

INSTRUCTIONS FOR USING CHART: Select figure in FUEL column equal to or less than amount of fuel to be used for cruising(1). Move horizontally to right or left and select RANGE value equal to or greater than the statute or nautical air miles to be flown. Vertically below and opposite value nearest desired cruising altitude (ALT), read rpm, manifold pressure (MP), and MIXTURE setting required. Refer to corresponding column and altitude for new power settings when gross weight falls below limits of this chart.

NOTES: Column I is for emergency high-speed cruising only. Columns II, III, IV, and V give progressive increase in range at a sacrifice in speed. Air miles per gallon (MI/GAL) (no wind), gallons per hr (GPH), and true airspeed (TAS) are approximate values for reference. Range values are for an average airplane flying alone (no wind)(1).

COLUMN I		FUEL(1) US. GAL	COLUMN II		COLUMN III		COLUMN IV		FUEL(1) US. GAL	COLUMN V	
RANGE IN AIR MILES			RANGE IN AIR MILES		RANGE IN AIR MILES		RANGE IN AIR MILES			RANGE IN AIR MILES	
STATUTE	NAUTICAL		STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL		STATUTE	NAUTICAL
			SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING(1)								
1215	1055	400	1375	1195	1580	1370	1760	1530	400	1910	1660
1095	950	360	1240	1075	1420	1230	1585	1375	360	1720	1495
970	840	320	1100	955	1265	1100	1410	1220	320	1530	1330
850	740	280	965	840	1110	965	1230	1070	280	1340	1160
730	635	240	825	715	950	825	1055	915	240	1145	995
610	530	200	690	600	790	685	880	765	200	955	830
485	420	160	550	475	630	545	705	610	160	765	665
365	315	120	410	355	475	410	525	455	120	575	500
245	210	80	275	240	315	275	350	305	80	380	330
120	105	40	140	120	160	140	175	150	40	190	165

MAXIMUM CONTINUOUS						PRESS ALT FEET	(3.44 STAT. (2.99 NAUT.) MI/GAL)						(3.95 STAT. (3.43 NAUT.) MI/GAL)					
RPM	MP IN.	MIXTURE	APPROX TOTAL GPH	APPROX TAS MPH	APPROX TAS KN		RPM	MP IN.	MIXTURE	APPROX TOTAL GPH	APPROX TAS MPH	APPROX TAS KN	RPM	MP IN.	MIXTURE	APPROX TOTAL GPH	APPROX TAS MPH	APPROX TAS KN
						40,000												
						35,000												
	SEE COLUMN III					30,000							2700	46.0	RUN	98	387	336
	SEE COLUMN II					25,000	2700	46.0	RUN	97	367	319	2600	44.0	RUN	92	364	316
	SEE COLUMN II					20,000	2700	46.0	RUN	100	370	321	2600	43.5	RUN	91	361	313
	SEE COLUMN II					15,000	2700	46.0	RUN	100	350	304	2350	41.0	RUN	82	329	286
2700	46	RUN	99	330	286	10,000	2650	45.0	RUN	95	326	283	2250	40.0	RUN	76	301	261
2700	46	RUN	97	309	268	5,000	2550	43.5	RUN	87	300	260	2100	39.0	RUN	69	274	238
2700	46	RUN	95	289	251	SL	2400	42.5	RUN	80	276	240	2000	38.0	RUN	63	250	217

(4.40 STAT. (3.82 NAUT.) MI/GAL)						PRESS. ALT FEET	MAXIMUM AIR RANGE					
RPM	MP IN.	MIXTURE	APPROX TOTAL GPH	APPROX TAS MPH	APPROX TAS KN		RPM	MP IN.	MIXTURE	APPROX TOTAL GPH	APPROX TAS MPH	APPROX TAS KN
						40,000						
						35,000						
2400	40.5	RUN	84	371	322	30,000	2350	36.0	RUN	73	349	303
2250	40.5	RUN	78	348	302	25,000	2150	36.0	RUN	67	323	280
2300	38.0	RUN	75	330	286	20,000	2100	29.5	RUN	59	285	247
2100	35.5	RUN	67	297	258	15,000	1850	29.0	RUN	52	249	216
1850	35.5	RUN	60	265	230	10,000		SEE COLUMN IV				
1750	35.5	RUN	54	239	207	5,000		SEE COLUMN IV				
1700	32.5	RUN	48	210	182	SL		SEE COLUMN IV				

SPECIAL NOTES

(1) Make allowance for warm-up, take-off, and climb plus allowance for wind, reserve, and combat as required.
(2) See figure A-6 for wet operation. High blower above heavy line.

EXAMPLE

At 9500 lb gross weight with 200 gal of fuel (after deducting total allowances of 30 gal) to fly 1230 stat. air miles at 15,000 ft altitude, maintain 2100 rpm and 35.5 in. manifold pressure with mixture set: RUN.

LEGEND

ALT - PRESSURE ALTITUDE
MP - MANIFOLD PRESSURE
GPH - US. GALLONS PER HOUR
TAS - TRUE AIRSPEED
KN - KNOTS
SL - SEA LEVEL
F.T. - FULL THROTTLE

REVISED 2-20-47
DATA AS OF 10-1-46
BASED ON: FLIGHT TEST

F-51H-1-93-4

FUEL GRADE: 100/130

FUEL DENSITY: 6.0 LB/GAL

Figure A-11. Flight Operation Instruction Chart—11,800 to 7600 Pounds (Sheet 2 of 2)

WADC Form 241K (11 Jun 51)

AIRCRAFT MODEL (S) F-51H

ENGINE(S): (1) V-1650-9

FLIGHT OPERATION INSTRUCTION CHART

STANDARD DAY

CHART WEIGHT LIMITS: 12,600 TO 11,300 POUNDS

EXTERNAL LOAD ITEMS

SIX ROCKETS PLUS TWO 165 GAL DROP TANKS, SIX ROCKETS PLUS TWO 110 GAL DROP TANKS, SIX ROCKETS PLUS TWO 75 GAL DROP TANKS, SIX ROCKETS PLUS TWO 500 LB BOMBS, OR SIX ROCKETS PLUS ONE 110 GAL DROP TANK AND ONE 1000 LB BOMB

LIMITS	RPM	MP IN HG	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	COOLANT TEMP	TOTAL GPH
WAR EMER(2)	3000 3000	67 67	LOW HIGH	RUN RUN	5 MIN	135°C 135°C	210 180
MILITARY POWER	3000 3000	61 61	LOW HIGH	RUN RUN	15 MIN	125°C 125°C	180 150

INSTRUCTIONS FOR USING CHART: Select figure in FUEL column equal to or less than amount of fuel to be used for cruising(1). Move horizontally to right or left and select RANGE value equal to or greater than the statute or nautical air miles to be flown. Vertically below and opposite value nearest desired cruising altitude (ALT), read rpm, manifold pressure (MP), and MIXTURE setting required. Refer to corresponding column and altitude for new power settings when gross weight falls below limits of this chart.

NOTES: Column I is for emergency high-speed cruising only. Columns II, III, IV, and V give progressive increase in range at a sacrifice in speed. Air miles per gallon (MI/GAL) (no wind), gallons per hr (GPH), and true airspeed (TAS) are approximate values for reference. Range values are for an average airplane flying alone (no wind)(1).

COLUMN I		FUEL(1) US. GAL	COLUMN II		COLUMN III		COLUMN IV		FUEL(1) US. GAL	COLUMN V	
RANGE IN AIR MILES			RANGE IN AIR MILES		RANGE IN AIR MILES		RANGE IN AIR MILES			RANGE IN AIR MILES	
STATUTE	NAUTICAL		STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL		STATUTE	NAUTICAL
				SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING(1)							
1605	1395	580	1825	1585	2005	1740	2145	1860	580	2305	2000
1495	1300	540	1695	1470	1865	1620	1995	1730	540	2140	1860
1385	1200	500	1565	1360	1725	1500	1845	1600	500	1980	1720
1275	1105	460	1440	1250	1585	1375	1695	1470	460	1815	1575
1165	1010	420	1310	1140	1440	1250	1545	1340	420	1650	1430
1050	910	380	1185	1030	1300	1130	1395	1210	380	1490	1295
940	815	340	1055	915	1160	1005	1245	1080	340	1325	1150

MAXIMUM CONTINUOUS						PRESS. ALT FEET	(3.07 STAT. (2.67 NAUT.) MI/GAL)						(3.36 STAT. (2.92 NAUT.) MI/GAL)						(3.62 STAT. (3.14 NAUT.) MI/GAL)						PRESS. ALT FEET	MAXIMUM AIR RANGE					
RPM	MP IN.	MIX TURE	APPROX TOTAL GPH	TAS MPH	TAS KN		RPM	MP IN.	MIX-TURE	APPROX TOTAL GPH	TAS MPH	TAS KN	RPM	MP IN.	MIX-TURE	APPROX TOTAL GPH	TAS MPH	TAS KN	RPM	MP IN.	MIX-TURE	APPROX TOTAL GPH	TAS MPH	TAS KN		RPM	MP IN.	MIX-TURE	APPROX TOTAL GPH	TAS MPH	TAS KN
						40,000																			40,000						
						35,000																			35,000						
						30,000																			30,000						
	SEE COLUMN II					25,000	2700	46.0	RUN	97	327	284							2500	43.0	RUN	88	320	278	25,000	2350	41.0	RUN	81	308	267
	SEE COLUMN II					20,000	2700	46.0	RUN	100	335	291	2700	45.5	RUN	97	334	290	2550	43.0	RUN	89	323	281	20,000	2400	40.5	RUN	80	305	265
	SEE COLUMN II					15,000	2700	46.0	RUN	100	321	279	2600	44.0	RUN	92	311	270	2300	41.0	RUN	80	292	254	15,000	2100	34.5	RUN	66	250	217
	SEE COLUMN II					10,000	2700	46.0	RUN	99	307	267	2500	43.0	RUN	99	289	251	2100	39.0	RUN	72	259	225	10,000			SEE COLUMN IV			
2700	46	RUN	97	282	245	5,000	2600	44.5	RUN	91	277	241	2250	40.5	RUN	75	256	222	1950	37.5	RUN	63	229	199	5,000			SEE COLUMN IV			
2700	46	RUN	95	266	230	SL	2500	43.0	RUN	84	256	221	2150	39.5	RUN	69	232	202	1800	36.0	RUN	54	195	169	SL			SEE COLUMN IV			

SPECIAL NOTES

(1) Make allowance for warm-up, take-off, and climb plus allowance for wind, reserve, and combat as required.

(2) See figure A-6 for wet operation. High blower above heavy line.

EXAMPLE

At 12,000 lb gross weight with 500 gal of fuel (after deducting total allowances of 30 gal) to fly 1980 stat. air miles at 15,000 ft altitude, maintain 2100 rpm and 34.5 in. manifold pressure with mixture set: RUN. When gross weight reaches 11,300 lb, use sheet 2, column V.

LEGEND

ALT - PRESSURE ALTITUDE
MP - MANIFOLD PRESSURE
GPH - US. GALLONS PER HOUR
TAS - TRUE AIRSPEED
KN - KNOTS
SL - SEA LEVEL
F.T. - FULL THROTTLE

REVISED 2-20-47
DATA AS OF: 10-1-45
BASED ON: FLIGHT TEST

F-51H-1-93-5

FUEL GRADE: 100/130

FUEL DENSITY: 6.0 LB/GAL

Figure A-12. Flight Operation Instruction Chart—12,600 to 8400 Pounds (Sheet 1 of 2)

WADC Form 241K (11 Jun 51)

AIRCRAFT MODEL (S)	FLIGHT OPERATION INSTRUCTION CHART	EXTERNAL LOAD ITEMS
F-51H ENGINE(S): (1) V-1650-9	STANDARD DAY CHART WEIGHT LIMITS: 11,300 TO 8400 POUNDS	SIX ROCKETS PLUS TWO 165 GAL DROP TANKS, SIX ROCKETS PLUS TWO 110 GAL DROP TANKS, SIX ROCKETS PLUS TWO 75 GAL DROP TANKS, SIX ROCKETS PLUS TWO 500 LB BOMBS, OR SIX ROCKETS PLUS ONE 110 GAL DROP TANK AND ONE 1000 LB BOMB

LIMITS	RPM	MP IN HG	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	COOLANT TEMP	TOTAL GPH
WAR EMER(2)	3000 3000	67 67	LOW HIGH	RUN RUN	5 MIN	135°C 135°C	210 180
MILITARY POWER	3000 3000	61 61	LOW HIGH	RUN RUN	15 MIN	125°C 125°C	180 160

INSTRUCTIONS FOR USING CHART: Select figure in FUEL column equal to or less than amount of fuel to be used for cruising(1). Move horizontally to right or left and select RANGE value equal to or greater than the statute or nautical air miles to be flown. Vertically below and opposite value nearest desired cruising altitude (ALT), read rpm, manifold pressure (MP), and MIXTURE setting required. Refer to corresponding column and altitude for new power settings when gross weight falls below limits of this chart.

NOTES: Column I is for emergency high-speed cruising only. Columns II, III, IV, and V give progressive increase in range at a sacrifice in speed. Air miles per gallon (MI/GAL) (no wind), gallons per hr (GPH), and true airspeed (TAS) are approximate values for reference. Range values are for an average airplane flying alone (no wind)(1).

COLUMN I		FUEL(1) US. GAL	COLUMN II		COLUMN III		COLUMN IV		FUEL(1) US. GAL	COLUMN V	
RANGE IN AIR MILES			RANGE IN AIR MILES		RANGE IN AIR MILES		RANGE IN AIR MILES			RANGE IN AIR MILES	
STATUTE	NAUTICAL		STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL		STATUTE	NAUTICAL
			SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING(1)								
1330	1155	480	1530	1330	1685	1460	1800	1560	480	1960	1700
1220	1060	440	1400	1215	1545	1340	1650	1430	440	1800	1560
1110	965	400	1270	1100	1405	1220	1500	1300	400	1635	1420
995	865	360	1145	995	1265	1100	1350	1170	360	1470	1275
885	770	320	1020	885	1125	975	1200	1040	320	1310	1135
775	675	280	890	770	985	855	1050	910	280	1145	995
665	575	240	765	665	845	735	900	780	240	980	850
555	480	200	635	550	705	610	750	650	200	815	705
445	385	160	510	440	560	485	600	520	160	655	570
330	285	120	380	330	420	365	460	390	120	490	425
220	190	80	255	220	280	245	300	260	80	325	280
110	95	40	125	110	140	120	150	130	40	165	145

MAXIMUM CONTINUOUS						PRESS. ALT FEET	(3.18 STAT. (2.76 NAUT.) MI/GAL)						(3.51 STAT. (3.05 NAUT.) MI/GAL)						(3.75 STAT. (3.26 NAUT.) MI/GAL)						PRESS. ALT FEET	MAXIMUM AIR RANGE					
RPM	MP IN.	MIXTURE	APPROX TOTAL GPH	TAS MPH	TAS KN		RPM	MP IN.	MIXTURE	APPROX TOTAL GPH	TAS MPH	TAS KN	RPM	MP IN.	MIXTURE	APPROX TOTAL GPH	TAS MPH	TAS KN	RPM	MP IN.	MIXTURE	APPROX TOTAL GPH	TAS MPH	TAS KN		RPM	MP IN.	MIXTURE	APPROX TOTAL GPH	TAS MPH	TAS KN
						40,000																			40,000						
						35,000																			35,000						
	SEE COLUMN III					30,000							2700	46.0	RUN	98	346	300	2450	43.0	RUN	88	336	292	30,000	2400	37.5	RUN	77	313	272
	SEE COLUMN II					25,000	2700	46.0	RUN	97	331	288	2650	45.0	RUN	94	330	286	2400	42.5	RUN	85	320	278	25,000	2200	38.0	RUN	72	295	250
	SEE COLUMN II					20,000	2700	46.0	RUN	100	337	293	2650	44.5	RUN	95	332	288	2400	41.5	RUN	82	312	271	20,000	2150	31.0	RUN	62	254	220
	SEE COLUMN II					15,000	2700	46.0	RUN	100	318	276	2400	41.5	RUN	84	298	259	2150	38.5	RUN	73	276	240	15,000		SEE COLUMN IV				
2700	46	RUN	99	300	260	10,000	2650	44.5	RUN	93	295	256	2250	40.5	RUN	77	272	236	1950	37.0	RUN	65	244	212	10,000		SEE COLUMN IV				
2700	46	RUN	97	281	244	5,000	2500	43.0	RUN	85	270	234	2150	39.0	RUN	70	247	214	1850	36.5	RUN	58	221	192	5,000		SEE COLUMN IV				
2700	46	RUN	95	262	227	SL	2350	41.5	RUN	77	246	214	2000	38.0	RUN	63	221	192	1700	35.0	RUN	50	189	164	SL		SEE COLUMN IV				

SPECIAL NOTES

(1) Make allowance for warm-up, take-off, and climb plus allowance for wind, reserve, and combat as required.
(2) See figure A-6 for wet operation. High blower above heavy line.

EXAMPLE

At 10,000 lb gross weight with 400 gal of fuel (after deducting total allowances of 50 gal) to fly 1500 stat. air miles at 10,000 ft altitude, maintain 1950 rpm and 37 in. manifold pressure with mixture set: RUN.

LEGEND

ALT - PRESSURE ALTITUDE
MP - MANIFOLD PRESSURE
GPH - US. GALLONS PER HOUR
TAS - TRUE AIRSPEED
KN - KNOTS
SL - SEA LEVEL
F.T. - FULL THROTTLE

REVISED 2-20-47
DATA AS OF: 10-1-45
BASED ON: FLIGHT TEST

F-51H-1-93-6

FUEL GRADE: 100/130

FUEL DENSITY: 6.0 LB/GAL

Figure A-12. Flight Operation Instruction Chart—12,600 to 8400 Pounds (Sheet 2 of 2)

WADC Form 241K (11 Jun 51)

AIRCRAFT MODEL (S)

F-51H

ENGINE(S): (1) V-1650-9

FLIGHT OPERATION INSTRUCTION CHART

STANDARD DAY

CHART WEIGHT LIMITS: 12,400 TO 10,300 POUNDS

EXTERNAL LOAD ITEMS

SIX ROCKETS PLUS TWO 1000 LB BOMBS

LIMITS	RPM	MP IN HG	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	COOLANT TEMP	TOTAL GPH
WAR EMER(2)	3000 3000	67 67	LOW HIGH	RUN RUN	5 MIN	135°C 135°C	210 180
MILITARY POWER	3000 3000	61 61	LOW HIGH	RUN RUN	15 MIN	125°C 125°C	180 150

INSTRUCTIONS FOR USING CHART: Select figure in FUEL column equal to or less than amount of fuel to be used for cruising(1). Move horizontally to right or left and select RANGE value equal to or greater than the statute or nautical air miles to be flown. Vertically below and opposite value nearest desired cruising altitude (ALT), read rpm, manifold pressure (MP), and MIXTURE setting required. Refer to corresponding column and altitude for new power settings when gross weight falls below limits of this chart.

NOTES: Column I is for emergency high-speed cruising only. Columns II, III, IV, and V give progressive increase in range at a sacrifice in speed. Air miles per gallon (MI/GAL) (no wind), gallons per hr (GPH), and true airspeed (TAS) are approximate values for reference. Range values are for an average airplane flying alone (no wind)(1).

COLUMN I: RANGE IN AIR MILES STATUTE	COLUMN I: NAUTICAL	FUEL(1) US. GAL	COLUMN II: RANGE IN AIR MILES STATUTE	COLUMN II: NAUTICAL	COLUMN III: RANGE IN AIR MILES STATUTE	COLUMN III: NAUTICAL	COLUMN IV: RANGE IN AIR MILES STATUTE	COLUMN IV: NAUTICAL	FUEL(1) US. GAL	COLUMN V: RANGE IN AIR MILES STATUTE	COLUMN V: NAUTICAL
			SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING(1)								
680	590	250	735	640	810	705	885	770	250	925	805
570	495	210	620	540	680	590	745	645	210	780	675
460	400	170	500	435	550	475	605	525	170	630	545
350	305	130	380	330	420	365	460	400	130	480	415
245	210	90	265	230	290	250	320	280	90	335	290
135	115	50	145	125	160	140	180	155	50	185	160

MAXIMUM CONTINUOUS						PRESS. ALT FEET	(2.95 STAT. (2.56 NAUT.) MI/GAL)						(3.23 STAT. (2.80 NAUT.) MI/GAL)						(3.55 STAT. (3.08 NAUT.) MI/GAL)						PRESS. ALT FEET	MAXIMUM AIR RANGE					
RPM	MP IN.	MIXTURE	APPROX TOTAL GPH	TAS MPH	TAS KN		RPM	MP IN.	MIXTURE	APPROX TOTAL GPH	TAS MPH	TAS KN	RPM	MP IN.	MIXTURE	APPROX TOTAL GPH	TAS MPH	TAS KN	RPM	MP IN.	MIXTURE	APPROX TOTAL GPH	TAS MPH	TAS KN		RPM	MP IN.	MIXTURE	APPROX TOTAL GPH	TAS MPH	TAS KN
						40,000																			40,000						
						35,000																			35,000						
						30,000																			30,000						
	SEE COLUMN III					25,000							2700	46.0	RUN	87	321	278	2500	43.0	RUN	88	314	273	25,000	2350	41.0	RUN	81	302	262
	SEE COLUMN III					20,000							2700	46.0	RUN	100	328	285	2500	43.0	RUN	88	313	272	20,000	2350	40.0	RUN	79	293	254
	SEE COLUMN II					15,000	2700	46	RUN	100	310	269	2600	44.0	RUN	92	302	262	2250	40.0	RUN	79	281	244	15,000	2100	35.5	RUN	67	249	216
	SEE COLUMN II					10,000	2700	46	RUN	99	293	254	2400	42.5	RUN	84	275	239	2050	38.5	RUN	69	247	214	10,000		SEE COLUMN IV				
2700	46	RUN	97	274	238	5,000	2600	44	RUN	89	267	232	2200	40.0	RUN	74	246	214	1950	37.5	RUN	63	220	191	5,000		SEE COLUMN IV				
2700	46	RUN	95	256	222	SL	2400	42	RUN	79	242	210	2100	39.0	RUN	69	222	193	1800	35.5	RUN	53	188	163	SL		SEE COLUMN IV				

SPECIAL NOTES

(1) Make allowance for warm-up, take-off, and climb plus allowance for wind, reserve, and combat as required.
(2) See figure A-6 for wet operation. High blower above heavy line.

EXAMPLE

At 11,000 lb gross weight with 210 gal of fuel (after deducting total allowances of 40 gal) to fly 885 stat. air miles at 10,000 ft altitude, maintain 2050 rpm and 38.5 in. manifold pressure with mixture set: RUN.

LEGEND

ALT - PRESSURE ALTITUDE
MP - MANIFOLD PRESSURE
GPH - US. GALLONS PER HOUR
TAS - TRUE AIRSPEED
KN - KNOTS
SL - SEA LEVEL
F.T. - FULL THROTTLE

REVISED 2-25-47
DATA AS OF: 10-1-45
BASED ON: FLIGHT TEST

F-51H-1-93-7

FUEL GRADE: 100/130

FUEL DENSITY: 6.0 LB/GAL

Figure A-13. Flight Operation Instruction Chart—12,400 to 10,300 Pounds

WADC Form 241K (11 Jun 51)

AIRCRAFT MODEL (S)

F-51H

ENGINE(S): (1) V-1650-9

FLIGHT OPERATION INSTRUCTION CHART

STANDARD DAY

CHART WEIGHT LIMITS: 9500 TO 7400 POUNDS

EXTERNAL LOAD ITEMS

WING RACKS

LIMITS	RPM	MP IN HG	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	COOLANT TEMP	TOTAL GPH
WAR EMER[2]	3000 3000	67 67	LOW HIGH	RUN RUN	5 MIN	135°C 135°C	210 180
MILITARY POWER	3000 3000	61 61	LOW HIGH	RUN RUN	15 MIN	125°C 125°C	180 150

INSTRUCTIONS FOR USING CHART: Select figure in FUEL column equal to or less than amount of fuel to be used for cruising[1]. Move horizontally to right or left and select RANGE value equal to or greater than the statute or nautical air miles to be flown. Vertically below and opposite value nearest desired cruising altitude (ALT), read rpm, manifold pressure (MP), and MIXTURE setting required. Refer to corresponding column and altitude for new power settings when gross weight falls below limits of this chart.

NOTES: Column I is for emergency high-speed cruising only. Columns II, III, IV, and V give progressive increase in range at a sacrifice in speed. Air miles per gallon (MI/GAL) (no wind), gallons per hr (GPH), and true airspeed (TAS) are approximate values for reference. Range values are for an average airplane flying alone (no wind)[1].

COLUMN I RANGE IN AIR MILES STATUTE	COLUMN I NAUTICAL	FUEL[1] US. GAL	COLUMN II RANGE IN AIR MILES STATUTE	COLUMN II NAUTICAL	COLUMN III RANGE IN AIR MILES STATUTE	COLUMN III NAUTICAL	COLUMN IV RANGE IN AIR MILES STATUTE	COLUMN IV NAUTICAL	FUEL[1] US. GAL	COLUMN V RANGE IN AIR MILES STATUTE	COLUMN V NAUTICAL
			SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING[1]								
815	710	250	955	830	1090	945	1220	1060	250	1300	1130
685	595	210	805	700	915	795	1025	890	210	1090	945
555	480	170	650	565	740	645	830	720	170	885	770
425	370	130	500	435	565	490	635	550	130	675	585
295	255	90	345	300	390	340	440	380	90	470	410
165	145	50	190	165	220	190	245	210	50	260	225

MAXIMUM CONTINUOUS RPM	MP IN.	MIXTURE	APPROX TOTAL GPH	TAS MPH	TAS KN	PRESS ALT FEET	(3.83 STAT. (3.32 NAUT.) MI/GAL) RPM	MP IN.	MIXTURE	APPROX TOTAL GPH	TAS MPH	TAS KN
						40,000						
	SEE COLUMN II					35,000	2700	46.0	RUN	98	422	367
	SEE COLUMN II					30,000	2700	46.0	RUN	98	411	357
	SEE COLUMN II					25,000	2700	46.0	RUN	97	392	340
	SEE COLUMN II					20,000	2700	46.0	RUN	100	396	344
2700	46	RUN	100	372	323	15,000	2650	45.0	RUN	96	368	320
2700	46	RUN	99	351	305	10,000	2550	43.5	RUN	89	342	297
2700	46	RUN	97	329	286	5,000	2400	42.5	RUN	82	315	273
2700	46	RUN	95	308	268	SL	2300	41.0	RUN	76	289	251

PRESS ALT FEET	(4.35 STAT. (3.78 NAUT.) MI/GAL) RPM	MP IN.	MIXTURE	APPROX TOTAL GPH	TAS MPH	TAS KN	(4.76 STAT. (4.14 NAUT.) MI/GAL) RPM	MP IN.	MIXTURE	APPROX TOTAL GPH	TAS MPH	TAS KN
40,000												
35,000	2600	44.0	RUN	95	420	365	2500	40.5	RUN	84	407	353
30,000	2600	44.0	RUN	94	408	355	2400	40.0	RUN	82	392	340
25,000	2500	43.0	RUN	88	336	335	2250	40.0	RUN	76	367	319
20,000	2450	42.0	RUN	85	375	326	2250	37.0	RUN	73	345	300
15,000	2200	39.5	RUN	77	341	296	2050	34.0	RUN	65	312	271
10,000	2150	39.0	RUN	72	314	273	1850	35.0	RUN	58	281	244
5,000	2000	38.0	RUN	65	286	248	1700	35.0	RUN	53	252	219
SL	1950	37.0	RUN	60	261	227	1700	29.5	RUN	45	217	188

PRESS ALT FEET	MAXIMUM AIR RANGE RPM	MP IN.	MIXTURE	APPROX TOTAL GPH	TAS MPH	TAS KN
40,000						
35,000	2400	35.0	RUN	74	387	336
30,000	2350	35.0	RUN	71	369	320
25,000	2150	35.0	RUN	65	341	296
20,000	2100	29.5	RUN	59	308	268
15,000	1850	28.5	RUN	50	262	227
10,000		SEE COLUMN IV				
5,000		SEE COLUMN IV				
SL		SEE COLUMN IV				

SPECIAL NOTES

(1) Make allowance for warm-up, take-off, and climb plus allowance for wind, reserve, and combat as required.
(2) See figure A-6 for wet operation. High blower above heavy line.

EXAMPLE

At 9000 lb gross weight with 210 gal of fuel (after deducting total allowances of 45 gal) to fly 915 stat. air miles at 10,000 ft altitude, maintain 2150 rpm and 39 in. manifold pressure with mixture set: RUN.

LEGEND

ALT - PRESSURE ALTITUDE
MP - MANIFOLD PRESSURE
GPH - US. GALLONS PER HOUR
TAS - TRUE AIRSPEED
KN - KNOTS
SL - SEA LEVEL
F.T. - FULL THROTTLE

REVISED 2-25-47
DATA AS OF: 9-17-45
BASED ON: FLIGHT TEST

F-51H-1-93-2

FUEL GRADE: 100/130

FUEL DENSITY: 6.0 LB/GAL

Figure A-14. Flight Operation Instruction Chart—9500 to 7400 Pounds